HANDBOOK OF DOMESTIC SCIENCE AND HOUSEHOLD ARTS

WILSON

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HANDBOOK OF

DOMESTIC SCIENCE AND HOUSEHOLD ARTS

FOR USE IN

ELEMENTARY SCHOOLS

A MANUAL FOR TEACHERS

WITH A PREFACE BY

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AND

WITH CHAPTERS CONTRIBUTED BY OTHER WELL KNOWN SPECIALISTS

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New York
THE MACMILLAN COMPANY
LONDON: MACMILLAN & CO., LTD.
1900

Norwood Press
J. S. Cushing & Co. — Berwick & Smith
Norwood Mass. U.S.A.

"Till by experience taught the mind shall learn
That, not to know at large of things remote
From use, obscure and subtle, but to know
That which before us lies in daily life,
Is the prime wisdom."

—John Milton.

PREFACE

According to a prevalent theory of education, the child acquaints himself with the various objects of his environment in order to have a basis of choice in his after life as well as to develope his observing faculties. The knowledge which he consciously or unconsciously gains in his early years remains indelible, as do the letters lightly cut in the bark of a young sapling, which may be read even more distinctly in the grown tree.

Owing to the rapid changes in environment, — economic, industrial, mechanical, and social; — many a teacher finds herself at a loss in trying to aid her pupils to find their place in a world which is almost as new to her as to them. Where everything is in a more or less plastic condition, firm foothold is not possible, and the already overworked teacher is not able to search out the truth from the multitude of books, to understand the new processes, to keep up with the daily inventions.

To the child's endless "Why?" and "How?" she must turn a deaf ear, or she must "work up" the various subjects from newspaper or magazine articles based on encyclopædias, which are admirable epitomes of past and gone history, but most misleading and insufficient as to growing science.

This little book is an endeavor on the part of the several experienced teachers to put into a form helpful to others that which they themselves have gathered with much labor. The topics relate to that routine of daily life which influ-

ences every child for good or ill throughout its career, and which may be beneficial in proportion as it is understood and controlled.

Objection has been made to taking the time of the school for those things which the home should teach. If they were taught in the home, the objection would be valid; but, with the best will in the world, how can the mother, any more than the teacher, keep abreast of the revolutions in social habits which are now taking place? That she does *not* do so the present chaotic and unscientific condition of the household amply testifies. To interest the pupils of school age in the various operations of the daily life is to give them a safeguard for health and morality which will be of lasting benefit in the homes of rich and poor alike.

Although it is probable that no knowledge which could be gained in school would have a more profound effect on national wealth or on human happiness, yet it is evident that these teachers do not regard the work outlined in the following pages so much from the point of view of *information* as from that of education, that education which should be a development of the child's power over his environment, and over his own efficiency as a human being.

ELLEN H. RICHARDS.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
September, 1899.

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INTRODUCTION

The course of study outlined in the following pages has already been subjected to the test of practical application in the schoolroom, with excellent results. I believe that it may be pursued with profit, both to the teacher and to the pupil, in any or all of grammar grades, and in any school however poorly equipped.

It has been planned chiefly to meet the needs of the ordinary grade teacher in the public schools. It is designed as an answer to two questions which she will probably ask herself when invited to undertake this work, — questions which may present themselves so forcibly as to be received as insuperable objections to the further consideration of the matter.

"Can I teach this subject without special training?"

"Can I accomplish anything without a laboratory, that is to say, without special rooms equipped and set aside for this purpose?"

The answer to both questions is *yes*, for the first year of the course here presented does not presuppose special training on the part of the teacher, nor the use of special laboratories. It does, however, take for granted a strong desire on her part to do this work, a lively belief in its efficiency, and an earnest effort to become better acquainted with the facts and philosophy of everyday home life.

The grade teacher who first earnestly teaches as much as she can without a laboratory will have the most con-

vincing argument on her side when she asks, as she certainly will, for rooms properly arranged and equipped for the purpose. To such Miss McNear's chapter on "How to turn an Ordinary Schoolroom into a Workshop for the Study of Household Arts" will be full of valuable suggestions.

One of the chief merits of the book lies in the fact that since each chapter of this manual contains, by design, much more material than can possibly be used under the most advantageous circumstances in the single month in which it is placed, the teacher is thereby enabled to give a course or several courses adapted to her own peculiar needs and facilities. She may give with its aid: —

1. A course of one hour a week for one year, consisting of "housework." A laboratory is not absolutely necessary.

2. A course of two hours a week for one year, or one hour for two years, consisting of housework, mending, and food. A laboratory is not absolutely necessary.

3. A course of two hours a week for two years, consisting of housework, sewing, foods, principles of cooking, and some practice in the art. For this course a laboratory will be necessary.

4. A course of two hours a week for three years. This will include nearly all the material given in this volume. A laboratory will be necessary.

5. A four years' course, including more practice in sewing and cooking. For the efficient carrying out of this course the teacher will need for her own use in teaching the fourth year students a text-book for cooking similar to the "Boston Cooking School Cook-book" and Smith's "Needlework for Student Teachers." Laboratories are necessary.

Those who can give but one hour a week to the subject are urged to pay particular attention to Chapter I, in which are outlined ten topics, each of which might well occupy

one of the ten school months. Other chapters discuss each of these subjects with more detail.

To those who can spend at least two hours a week on this subject, the following division of the subject-matter is suggested: —

SEPTEMBER. — Development of the Home Ideal, Evolution of the House, General Considerations of Each of its Rooms. Chapter I on the *House Beautiful.*

OCTOBER. — *The Kitchen*, including the Range and Cleaning.

NOVEMBER. — *Foods:* Study of Food Materials and their Digestion.

DECEMBER. — *Foods:* Food Value, Dietaries, and Food Economies.

JANUARY. — *Principles of Cooking.*

FEBRUARY. — *The Dining Room*, including preparation of menus.

MARCH. — *The Bedroom*, including ventilation.

APRIL. — *Laundry.*

MAY. — *Household Pests.*

JUNE. — *Mending.*

For both of these general courses the Reader written to accompany this manual and intended for the use of pupils will be found of value. In it may be found the homes of literature, household customs of other ages and countries, studies of home materials, etc.

Those who can spend two consecutive years of two hours a week are advised to follow in the second year a course something like the following: —

SEPTEMBER. — Review the Chemistry of *Foods* and *Principles of Cooking.*

OCTOBER AND NOVEMBER. — *Starchy Foods and How to Cook Them.*

DECEMBER. — *Proteids and How to Cook Them.*

JANUARY. — *Fish, Oysters, and Salad.*

FEBRUARY. — *Cake and Pastry.*

MARCH. — *Invalid Cooking.*

APRIL. — *Advanced Laundry Work.*

MAY. — *House Cleaning and Household Pests.*

JUNE. — *Advanced Mending and Sewing.*

RELATED WORK: *Reading.* — The Reader accompanying this manual provides abundant reading matter. But with the aid of the typewriter and mimeograph, or even with the mimeograph alone, the intelligent teacher can provide her class with additional material by following up the numerous references, particularly to the various magazines.

Language. — Or she may use these same sources of material for her own information, imparting it to the children in oral language lessons. Carefully written exercises should follow all completed subjects.

It goes without saying in these progressive days, all new words belong to the next spelling lesson.

Arithmetic. — This is somewhat carefully worked out in the chapter on "Foods." Similar work may be done in connection with many of the other subjects. Do not fall into the prevalent error of thinking that in using the word "fish" in an arithmetical problem you are correlating arithmetic and domestic science! The problem must be real, not sham, and the relationship intrinsic, not artificial. Probably the

best opportunity for this applied arithmetic may be found in the planning and equipment of the rooms. The dimensions, areas, and costs are questions that must be solved by some. Why not by the pupils as well as the teacher?

In conclusion I should like to say that if the grade teacher feels as much interest and gathers as much knowledge in reading this volume as I did in reading each separate manuscript, as it came to my hands, then the mission of the book will be accomplished, and the day is near at hand when every school child in the land will be guided by intelligent hands over the threshold of that earthly Paradise, a clean, restful, beautiful home.

But remember,

> "It takes a MIND to drive the Body
> Even to a cleaner sty!"

L. L. W. WILSON.

PHILADELPHIA NORMAL SCHOOL,
January, 1900.

SEPTEMBER

THE HOUSE BEAUTIFUL

By MAY HAGGENBOTHAM

Late Director of Domestic Science and Art Courses at Drexel Institute, Philadelphia
Sometime Assistant Superintendent of Public Schools of Philadelphia

CHAPTER I

THE HOUSE BEAUTIFUL

By MAY HAGGENBOTHAM

"Our life can never be complete, never be rational or righteous, until it is beautiful. Only when every foul alley, every noxious home, every vulgar structure, and every base fashion is banished from the city and over all is spread the mantle of health and beauty, only then can . . . whatever city be ours be indeed the city of God."

From "A More Beautiful Public Life," by Edwin D. Mead.

The public school is responsible for the nurture and development of every civic virtue. The feeling for beauty is one of these virtues.

From first to last of his school life the child should be taught to aim at cleanliness and simplicity, and through these at beauty, in the schoolroom and in the home. Only in proportion as this teaching is given can we hope to banish the "foul alley and noxious home" and to replace the "vulgar structure and base fashion" with things of beauty.

This truth is pressing itself home to teachers everywhere, and not a few are asking, "How can we who have had no special training in matters of taste and art bring this influence into the lives of our pupils?"

It is the design of this chapter to answer this question in part at least. The subject is a broad one and needs a book rather than a chapter; but some suggestions can be made.

From the School to the Home. — It is repeatedly said that the teaching in the schools should find closer application

to the home. The problem is, how to make this application.

We cannot follow each pupil into his home and show him how to apply our teaching — how to make the best of his means and his limitations. We are masters of nothing but precept and example.

The most that the teacher can do is to use earnestly and vigorously every means of illustration afforded her by nature and by art to arouse and keep alive in the child a love for beauty, and then to make herself and her surroundings the best possible exponent of her teachings.

With the schoolroom an embodiment of the teacher's ideas of cleanliness, refinement, and beauty, she can lead the pupils to think about the home and desire to make it beautiful.

An Expedient. — In my own classes I have tried with gratifying results the expedient of constructing and furnishing an imaginary house that should meet all sanitary requirements and be convenient and beautiful; and I have never given any instruction that was received with more interest and enthusiasm than this was.

The Domestic Instinct. — The domestic instinct is very lively in young girls. Every one expects some day to have a home of her own, and she will go with you every step of the way in rearing it in fancy. Girls in the humblest as well as those in the most comfortable homes will enter into the matter with as much gravity and earnestness as though the actual work were in progress; and they will take endless pains to make observations of house plans, to visit houses that are building, to notice the shapes and styles of furniture, and the quality and color of fabrics that are displayed in the shops; and in every other way that you suggest, they will observe, compare, and form conclusions as to what is fitting and beautiful for their ideal home.

Moreover, such lessons reach into the real households. Many mothers have expressed their gratitude for them and have declared that a complete revolution in taste was in progress in their homes.

The plan of lessons here presented is not supposed to be binding as to form or number. It merely suggests a convenient way of presenting the matter, and may be adapted to individual requirements.

The Character of the Lessons. — It is not intended to vie with the courses in Household Art given in the Technical Schools; nor to present information to be given out to pupils as a set of directions for making *a* beautiful house; but simply and solely to suggest to the teacher in the elementary school how she may help her pupils to know the meaning of *the house beautiful*, the house that will be the expression of whatever intelligence and cultivation the circumstances of their lives have made it possible for them to obtain.

A Preface Suggested. — I should preface the lessons with a brief talk on the evolution of the modern house and the family social life. This should be quite general and informal. The object is not to give archæological knowledge; but simply to stimulate the intelligence and curiosity of the pupil and to create an interest in comparing the present with the past.

TOPIC I

The Construction of the House

The First Essential. — Emphasize the fact that the first conditions of beauty are health and wholesomeness, and that a healthful, beautiful location, good construction, perfect drainage, perfect plumbing, and perfect sanitary conditions generally, are indispensable to the house beautiful.

The House Plan. — Talk with the pupils about the general plan of houses in their town or city. Have them sketch the ground plan.

The plan presented in most cases will probably be the typical city house with the long entry, as indicated in Diagram 1. But in many of the newer houses the long entry is dispensed with, and a portion of the lower floor space taken for a small central hall, as indicated in Diagram 2.

Question the pupils as to the position of water and gas pipes and house drain; the height of cellar above ground, the height of rooms; position of the house in regard to the points of the compass (to determine which rooms get sunlight); the kind of floors, and other woodwork.

Let them make diagrams of the other floors. Sketch the plans on the blackboard.

Indicate what improvements may be made in the ordinary house plan in the way of providing greater conveniences for the housekeeper, better accommodations for servants, a simplified arrangement of the plumbing about a central shaft in order to dispense, as far as possible, with horizontal pipes, and anything else that will make this a house practical and comfortable.

All this can be made very simple and intelligible to young girls. A house plan of the simple character here suggested (a diagram, or outline of the floor plans without elevation) is no more difficult to deal with than an ordinary problem in mensuration, and the line of thought suggested will ultimately result in a better understanding of domestic architecture and a consequent demand for improvements in it.

Until women are educated in these things builders will not cease to depend on loudly decorated walls, mantel overshelves with wonderful combinations of little balustrades, looking glass and cheap mouldings, stationary

wardrobes with glued-on ornaments, and other such surface attractions, to sell or rent houses that have poor woodwork, bad floors, and worse plumbing. And legislation on sanitary matters can never be made thoroughly operative until women understand the principles of sanitation and enforce the laws in the home.

Valuable hints on construction and sanitation will be found in "Home Sanitation," a little handbook prepared by the Association of Collegiate Alumnæ.

More than one lesson may be needed on the present topic. Pupils may have very hazy ideas as to the outlines of rooms, the position of pipes, etc., and even as to how the gas and water get into the house.

Having constructed our ideal house, we will proceed to furnish it. The plan suggested in Diagram 2 has been chosen for the obvious advantages it offers of illustrating certain principles in furnishing. The next lesson will consider the vestibule.

TOPIC II

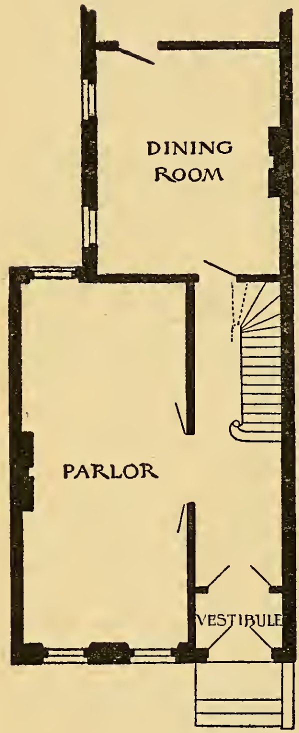
The Vestibule

Ask the *purpose* of the vestibule, and try to get the pupils to state what the purpose would naturally dictate as to furnishing and decorating.

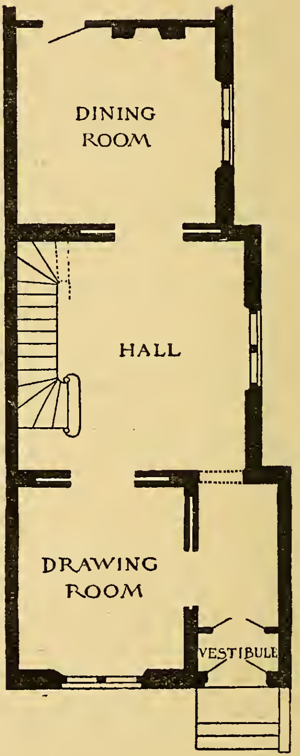
Have patience to draw them out. They have never thought much about so commonplace a subject.

Conditions to be dealt with. — Finally it will be answered that the vestibule is a part of the entrance to the house designed to protect the inner entrance and at times to shelter some one waiting. Then it can easily be established: —

Conclusions drawn from Facts. — 1. That as this part of the entrance is most of the time exposed to the weather, it should be and appear to be weather-proof.


DINING
ROOM
PARLOR
VESTIBULE

No. 1


DINING
ROOM
HALL
DRAWING
ROOM
VESTIBULE

No. 2

2. That as it serves to give one entering, the first impression of the abode and its inhabitants, therefore it should be pleasing and scrupulously neat and clean.

3. That as those entering receive but a passing impression, any elaborate decoration would be wasted; moreover, as the place stands open to public view, such decoration would not be in good taste.

Discuss the materials that would best meet all these conditions.

The conclusions reached will be something like the following: —

Suggestions for Furnishing.

The Floor. — 1. The floor should be covered with some weather-proof material, preferably marble, or tiles. If these are too expensive, linoleum may be used.

Side Walls. — 2. For the lower side walls the first choice would be marble, or tiles, corresponding to the floor. The second choice, hard plaster. If wood must be used, it should be treated so as to be weather-proof.

The side walls above the wainscoting should be, preferably, hard plaster. This should be tinted in some subdued flat color, as lapis-lazuli blue, pale green, or pearly gray.

A very pretty and suitable decoration is made by outlining panels on the side walls with strips of moulding. These may be painted in contrasting color or left in the natural state if of hard wood (explain this term).

Lighting. — For lighting, a gas fixture (or electric fixture) in the form of a lantern is most suitable. (Ask why.)

The conclusions may be gathered up by the teacher and written on the board at first.

Gathering up the Threads. — Enough time should be left of each lesson period to allow the pupils to write out an abstract of the lesson in their note-books. These should be carefully examined and corrected; but pupils should

be encouraged to express their own preferences and opinions.

At this stage the pupils will have become acquainted with the method of reasoning, and the subject of the next lesson may be given out. This means that students are expected to give some thought to the matter and to make all possible observations and bring suggestions to class.

TOPIC III

The First Floor Suite

The Hall

Satisfy yourself that the pupils have a clear mental picture of the space under consideration.

Matters to be Considered.

Discussion. — 1. The purposes of the hall and of each of the adjoining rooms — say there are two.

2. What common sense dictates as to the furnishing of these rooms. What limitations are imposed upon us by the fact that these three rooms open upon each other.

3. The treatment of the floor, the walls, the ceiling.

4. The movable furnishings.

Conclusions. — The needs and preferences of the family must determine the purposes to which these or any other rooms are to be put.

Builders seem to have intended the hall for a sort of living room, as they have given us a chimney place in it; but there can be no privacy for the family in a passageway, which this really is — so we had better decide to furnish it as a hall.

Like the vestibule, the hall serves to give some intimation of the general tone of refinement, or the lack of it, that one may look for in the occupants of the house. It is less formal

than the vestibule, as it shuts out the gaze of the world; but it is still outside of the real life of the home. Therefore, while it may be made quite bright, or even gay in tone, it must yet be somewhat formal. The room opening off to the front of the house may be taken for *a living room*; that on the other side, for *a dining room.*

We have a rather difficult problem — three rooms each having different uses yet coming together almost as one room. The use, the light, the woodwork, must all be considered in furnishing.

The Function of Floor and Walls in Decoration. — It is most important to secure harmony of effect in the color scheme. For this we must begin with the floors and the walls. These are the background for the furniture, and no matter how fine or beautiful our movables may be, the effect of all may be ruined by a bad arrangement of color in the background. With the color scheme right, however, the simplest and most inexpensive of furnishings may present a charming effect.

The floors then should be of uniform color throughout — if of good hard lumber and well laid, they may be left in the natural color, treated with oil or paraffin, and kept rubbed smooth and shining. Even rather inferior floors may be filled and stained and then treated in a way suitable to the wood.

(Samples of different woods should be shown the pupils, and directions given for the treatment suitable to each.)

Suggestions for Furnishing.

The Floors. — Rugs suited to the purposes of each room should be used. If Turkish rugs in rich, soft colors are too expensive, there are excellent Japanese and domestic rugs at lower prices. Rugs made of lengths of Brussels carpet are pretty and durable. In making a selection give first thought to the color. Avoid violent contrasts and figures that stand out obtrusively.

The Color of the Walls. — If there are large openings from the hall to the other rooms, select the papers for the three rooms at the same time and with reference to each other. We might for instance select a lighter shade of terra-cotta for the hall and darker shades of the same color for the other two rooms. Or a somewhat rich figured paper might be selected for the hall and harmonizing plain papers for the other two rooms.

In figured papers dignified designs should be used — those in vertical "repeats" of a climbing character, in which the figures melt into the background and do not stand out offensively.

Principles governing Selection.

Light and Mass. — Note that dark surfaces absorb light, whereas light surfaces reflect it. Also note that paper on the wall in mass is at least four shades darker than in the hand. Bear this in mind. In the matter of wall papers one is too prone to buy in haste and repent at leisure.

The Principle of Gradation. — We must observe the principle of gradation in forming our background of floor and walls; viz. the floors should be darkest — the strongest tones of color belong at the base; the walls should take the next tone lighter; the ceiling, the lightest. A frieze, carrying up the tone of the wall in lighter tint, should be finished with a picture rod the same color as the woodwork of the room.

Have a good supply of samples of wall paper, mouldings, fabrics of various colors, etc., for illustration, and let the pupils arrange and study various combinations of color and material. If you encourage them to do their own thinking and seeing, the power to judge correctly will grow rapidly.

The Furniture. — Instead of the conventional hall stand we may use a neatly framed mirror with pegs for hats,

and a polished wood bench or settee with the seat in the form of a box. Or the settee may be a strong willow one, with a cushion or two in accord with the general color scheme.

One or two substantial hall chairs, a table for magazines, a vase for flowers and a tray for cards, and a porcelain jar of good color, for holding sticks and umbrellas, complete the necessary furniture of the hall.

The Staircase. — The staircase forms part of the furnishing, and should carry out the general plan.

Decorations. — A few good pictures, decorative in character, may be used here.

A few plants suitable for indoors will serve to brighten the place; but we must see that they are well cared for.

As this room gets but little light, let the window curtain be a mere transparent screen set against the glass.

TOPIC IV

The First Floor Suite (*Continued*)

The Dining Room

Discussion. — 1. The meaning of this room in the social life of the family.

2. The character of the furnishings.

Conclusions. — It is here that the family, separated in their daily pursuits, meet together for social cheer. All should be serene and peaceful. No personal differences should be allowed to mar the general harmony. The surroundings should accord with the spirit. Cheerfulness should beam from every point.

Furniture. — The furniture should be simple and substantial: — a table standing firmly on its legs; chairs cane-seated or of other material easily kept clean; china closet

shining and well kept; a sideboard or table in keeping with the other pieces.

Decorations. — For adornment, a wainscoting carried well up on the walls may be finished with a plate rail on which may rest plates and plaques of good color. The mantelpiece may hold a piece of pottery or a cast, and some simple candelabra. Admit no meaningless ornaments.

Spotless table linen and neat dishes — they may be prettily decorated and yet cheap — are the crowning adornments of this room.

Historical Sketch. — It will add to the interest of this lesson to note that a separate room for taking meals — now a part of the house plan of even the workingman's home, is one of the luxuries of modern life. Even a generation ago old-fashioned people in England and America used their dining rooms as living rooms. In the Middle Ages the nobleman and his servants ate in the hall. The tables consisted of boards resting on trestles. The seats were narrow benches or stools so made that they could be easily carried away when the meal was over. The meals eaten in private were served in the lord's chamber. The mediæval chamber developed into a private suite of living rooms, the outer one of which came to be used as the family dining room.*

TOPIC V

The Living Room

Tradition vs. Individuality. — We have decided to give this name to the room on the opposite side of the hall. The needs and means of the family must really determine its use. No mere tradition as to what has been customary, or fancy as to what our neighbors might expect us to

* "The Decoration of Houses." — Wharton and Codman.

have, ought to weigh one feather's weight with us in determining how we shall use any room in our house. If the family is small and can afford to keep this as a company or reception room, it may be furnished daintily and used for that purpose. Otherwise it is folly and extravagance to stint the rest of the household appointments for the sake of furnishing a room with things too good to be used — a room from which every member of the family flees the moment the company leaves.

Discussion. — 1. The furnishings that will best serve the purposes for which this room is to be used.

2. Inexpensive materials that produce good effects.

3. The management of the color scheme.

Conclusions.

Suggestions for Furnishing. — 1. A firm, generous table that will hold books, magazines, and lamps; a comfortable divan with numerous pillows; plenty of easy chairs; plain, well-made bookcases or sets of shelves; and perhaps a corner cabinet in which to place objects of beauty and value. A few good pictures, — only *good* ones are worth looking at all the time; and an ornament or two of good form, — a vase, a cast or any object that is beautiful in color and form and made in suitable materials.

Artistic Effects with Inexpensive Materials. — 2. Strong willow chairs and couches with movable cushions may be used with good effect. The hangings in the room and the covers on the seat cushions may be of the same color and material. This gives a pleasing effect of unity. Denims are very satisfactory for this purpose; and when the hangings are ornamented with a bold embroidery of a white floss thread on the borders, the effect is charming.

The Color Scheme. — 3. We must remember that the floors and the walls have already been decided upon, and the

colors used must be such as will make no discord with this background. Choose the dominant tone of color in your room and keep everything else in accord with it.

Read with the pupils from Professor Morse's "Japanese Homes and their Surroundings," some descriptions of Japanese interiors. While we need not feel bound to prune our ideas to the simple severity of furnishing adhered to by the Japanese, we may be instructed by the elegance, refinement, and serenity of mind expressed in their surroundings.

TOPIC VI

The Bedrooms

The Attitude of the Teacher in these Lessons. — The most important principles of household furnishing have now been illustrated. Keep these principles clearly in your own mind and make each succeeding lesson illustrate them, leading the pupils *to deduce them* from the facts offered. In the end they should be able to formulate them and write them out in such shape as will impress them upon their minds. Of course the *principles* are the only really important things in the lessons. House furnishing is not an exact science. No hard and fast rules can be laid down as to how any one should furnish one's house. It should be an expression of one's own personal character and liking *guided by the fundamental principles of good taste.* The sole purpose of these lessons is to elucidate and inculcate these principles.

Serious Considerations.

Discussion. — 1. The sanitary requirements of the bedroom; why sun is more necessary here than in any other room in the house.

2. The furnishings consistent with sanitary requirements.

3. The adornments expressive of the individuality of the occupant.

A Test for the Pupils. — Instead of formulating the "conclusions" as in previous lessons, test the impression made by your teaching by letting the pupils write a description of a bedroom that shall satisfy all sanitary and artistic requirements. Let them call it "My Bedroom." It may be wholly imaginary of course. Read the best of the descriptions in class and supply any missing points.

Suggestion. — Give a brief historical sketch of the development of the bedroom, — its outgrowth as an escape from the promiscuity of the hall; its division into the company chamber (or drawing-room) and the actual sleeping room, which was, however, used as the family living room and as the scene of suppers, card parties, etc., and sometimes even as the kitchen.

This sketch may be gathered from "The Decoration of Houses," by Edith Wharton and Ogden Codman.

TOPIC VII

The Bath-room

Discussion. — 1. Sanitary principles and requirements.

2. Floors and walls.

3. Furnishing.

Conclusions.

Sanitary Requirements. — 1. All pipes must be exposed and easily accessible; all waste pipes trapped and ventilated; all fixtures set on legs or brackets; no woodwork that can possibly be dispensed with.

Suggestions for Furnishing.

Floor and Walls. — 2. A tiled floor if possible; linoleum the next choice; small rugs which can be easily dried.

Walls, tiled or painted. Paper is not desirable even when varnished. A hard wood wainscoting simply oiled,

and walls and ceiling painted in uniform tint is excellent. A stencilled frieze, or border above the wainscoting, of very simple design, adds to the attractiveness of the room.

Plumbing Fixtures.

Furnishings. — 3. A porcelain-lined or an enamelled-iron tub is indispensable.

A porcelain closet with no wood about it excepting the seat. No cover is needed.

A washstand set on legs or brackets.

Conveniences. — A neat rail with hooks, a towel-rack, and sets of shelves for small articles complete the necessary furnishings.

Ventilation. — Let everything be light — white if possible — and let the windows be free to admit air top and bottom.

TOPIC VIII

The Kitchen

The First Consideration. — Last though not least. In actual practice let it come first. Whatever money is left after the cellar and kitchen are furnished may be devoted to the other parts of the house. Leave "the parlor" to the last. If you make the kitchen as sweet and clean and pretty as it ought to be, you need not disdain to sit in it yourself nor to ask your friends to sit in it. If you doubt that a kitchen can be pretty, read the Vicar of Wakefield's description of his kitchen. Read the entire description of his house and see if you think it a *house beautiful.*

Suggestions for Furnishing.

The Floor. — If you are well off you may have a floor of tiles. The next best thing is a covering of linoleum.

The Walls. — The walls should be of tiles, or of glazed brick, or of hard plaster painted with waterproof paint or varnished.

Cupboards. — The doors of the cupboards should be of glass or should be dispensed with entirely. There should be absolutely no hiding places for dust or vermin. Kitchen utensils are just as appropriate to the kitchen as candelabra or vases to the parlor, and should be kept scrupulously clean and undisguisedly displayed there.

Good Taste in the Kitchen. — Indeed, Mr. Morris used to say that our kitchens were about the only rooms in our houses furnished in good taste, because all the articles there are "*of good shape, declare their use, and are appropriate to it.*" This is one of the fundamental principles of true decoration.

Indispensables. — A good, large, firm table for the use of the cook, wall strips with hooks for hanging her utensils within reach, and a few good strong, plain chairs, are indispensable furnishings.

The Sink and its Surroundings. — All the water and gas pipes should be exposed to view and all sinks set on legs or brackets. Have no closets under the sinks.

Even with moderate means a few tiles could be afforded to floor the space about the sink. Let them be white — gleaming white as everything about the plumbing should be — so that it will betray the first sign of uncleanliness.

Suggestions about Additional Lessons. — It is scarcely necessary to carry the illustrations farther as to separate rooms. The pupils may be required to continue the work, applying the principles and laws advanced. The proper furnishing of the servant's room should be considered equal in importance to that of any other room in the house. Closets, store-rooms, etc., should also be considered.

Review the general principles illustrated up to this point and add suggestions as to dealing with conditions not hitherto considered — such as furnishing a rented house

where we encounter obstacles to the application of right principles. This may occupy a separate lesson.

TOPIC IX

Making the Best of It

Our ideal house was above the average of ordinary houses — with fairly good woodwork, good sanitary conditions, and no obstacles in the shape of offensive wall decorations and stationary furniture.

Until a new era dawns in domestic architecture the woman who knows the good from the bad, but is compelled to live in rented flats will meet with many discouragements, and will be forced to exercise all her ingenuity and philosophy in making the best of it.

The First Thing to be Done. — Having chosen the least objectionable house we can find, we will attack the floors and woodwork, fill up the dust-holding cracks and make all as clean and smooth as possible.

Dealing with Obstacles. — If there is a long narrow entry, or rooms of similar shape to deal with, we must study what furnishings will best modify the unpleasing proportions.

If the walls and ceilings are covered with an objectionable figured paper, somewhat dark, a pale carpet will lower the stud and produce an impression of top heaviness and gloom; whereas a dark, rich carpet will do much to lighten the effect. If we have a light carpet that we *must* use, something will be gained by staining the floor, making the light carpet into a rug and using as little of it as possible.

We may further relieve the effect of an obtrusive paper by using plain masses of color in hangings and furniture cushions. Using the same color and materials in hangings and furniture produces an impression of unity and tends to give an air of spaciousness.

Right Principles in the Selection of Color. — Select for each room the color that will best accord with the background of floor and wall and let that be the dominant tone, making all else accord with it. So far as possible use warm colors for north and west rooms, and cool colors for south and east rooms. The fewer colors used the more pleasing and restful is the impression produced.

If a papering is very bad in color or pattern take it off and repaper the walls. It is not difficult work, and many a woman has done it.

Aids to the Cultivation of Taste. — In general, avoid decoration schemes offered in the papers and magazines. Master the few principles of good taste and test your individual likings by them. We do not always, without training, like the best. It would be a good plan to turn from time to time to Owen Jones's "Grammar of Ornament" and read over the "General Principles in the Arrangement of Form and Color." They are easily understood and many of them apply directly to the decoration of the home.

A Word to the Teacher. — The process of house furnishing, which is really a simple and intelligible thing, has been complicated by the endeavor to follow the fashions prevailing at various times. At present a feeling of more independence is growing up; do all in your power to strengthen this feeling in your pupils.

Necessary Lessons. — The lessons should include instruction in the systematic care of the house; they should also embrace the subject of materials to the extent of giving the housekeeper such knowledge as will enable her to tell good quality from bad, and to know the best way of caring for each article of furniture and adornment.

TOPIC X

The Use and Abuse of Ornament

Trashy ornament and fancy articles are among the most formidable enemies to the formation of taste. We must therefore try to inculcate some right ideas upon this subject.

The Universality of Ornament. — Call attention to the universality of ornament. The doors, the windows, the desks in the school, the furniture in the home, the vehicles on the streets, every article of common use — all have some moulding, or turning, or carving, or trimming which has nothing to do with the actual use of the object, but which is intended solely for ornament — to make the objects more pleasing to those who use them — and, it should be, to those who make them.

If we look about us in our homes we can see how many useless, meaningless things we have — things which can afford us no lasting pleasure, and which could have given none to the makers.

Things in which Ornament interferes with Use. — There are the cushions, pillows, and footstools beaded, spangled, and befrilled so that we carefully push them aside when we are in need of such things; there are the monstrous lamp-shades of silk and lace, or crimped paper, which threaten nightly conflagrations and serve to produce spasms of apprehension in those who attempt to make a light; chairs too fine to use, and many another monument to wasted money and labor.

A Waste of Fine Materials. — Then there are the fancy articles in which fine materials are misused to represent forms utterly incongruous with those materials; such as red velvet fiddles and banjos with gold cord strings (note others at the fancy goods counters at holiday seasons).

Things in the Wrong Place. — There are strange conceits

in table appliances: such as coal-scuttles and buckets for sugar holders; beehives and tubs for butter dishes; silver owls, with myriads of cruel holes punched in their heads, for pepper and salt dusters. — Surely no real pleasure can be taken in such things, and they are less convenient than the plain simple vessels whose places they have usurped.

Meaningless Trifles. — Then there are the meaningless trifles we set about on our tables and shelves for "ornaments" — such as vases and tea-cups that will hold nothing; tea-pots in the forms of birds and dragons, and numberless other absurdities.

A Test of Fitness. — I do not mean to say that we may not have ornaments of fine workmanship and material made in any of these forms, but the vase must be adapted to hold flowers and the cup to hold tea, because holding something is the office of these things; we may also have ornaments in the forms of birds and dragons, but they should not be turned into tea-pots. This is Mr. Morris's meaning when he declares, "No article is beautiful unless it is also useful."

These lists can be multiplied and a great deal of harmless amusement gotten out of them.

Simplicity and Economy. — Make a strong plea for simplicity and economy in the household. Apart from the question of good taste, the superfluous articles with which we load our houses add to the burden of whoever has to care for them and take money which could be better spent.

The "Lesser Arts." — It will add to the interest and value of the lesson to picture those times in the world's history when it was consciously sought to make the common things of life beautiful; when the potter, the carver, the metal worker, the weaver, the embroiderer were all artists in their way. We speak of their work as the "lesser arts" as compared with the statue and the painting; but there was no such separation between them as there is to-day. Many of

the great painters were goldsmiths, and many of the sculptors, stone carvers. Botticelli decorated the panels of linen closets. Benvenuto Cellini chiselled book clasps and drinking cups. The renowned Dutch painter, Hans Holbein, decorated the fronts of houses and painted fashion-plates for ladies' costumes.

Show pictures illustrating these facts, and wherever possible visit museums that contain beautiful examples of household furniture or ornament.

The Truths summed up. — Gather up the vital truths of this lesson in some such statements as the following: —

1. It is one function of art to give pleasure in the common things of life by giving them beauty of form, of pattern, and of color.

2. Decoration must never interfere with use.

3. The first law of good taste is *fitness;* and no amount of beauty in the material or of excellence in the workmanship can compensate for a lack of this quality in an object of decoration.

4. *Lasting pleasure* can be found only in thoroughly useful and well-constructed things, made out of good and suitable material, appearing in their appropriate places and fulfilling their proper uses.

5. Keep nothing in your house that is not either useful or beautiful.

Read, and let the pupils read, a little book by Lucy Crane containing six lectures on "Art and the Formation of Taste." The first two lectures bear on the present subject, and are very interesting and suggestive.

The teacher will find many suggestions — especially on the historical part of House Decoration — in Wharton and Codman's "The Decoration of Houses" (Scribner's, 1898).

It need scarcely be said to the intelligent teacher that the

hints on furnishing and decorating here given are not intended to be complete. Much has been omitted, partly from lack of space; and partly because the information can easily be supplied by the teacher.

The sole aim of the lessons is to arouse in the pupils a desire to make the home a place from which all beautiful influences shall emanate. And the sole aim of this chapter is to unfold to the teacher a plan that has been satisfactorily used by the writer.

"It is not instruction but provocation that one mind can give to another."

OCTOBER

I. THE KITCHEN

II. ADVANCED COURSE:

Starchy Foods and how to cook them

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CHAPTER II

THE KITCHEN

The Kitchen in Art

Dutch Kitchen, Maes, London ; *Dutch Kitchen*, Dou, Louvre, Paris ; *The Spinner*, Dou, Munich ; *Angel's Kitchen*, Murillo, Louvre, Paris.

The Kitchen in Literature

The Vicar of Wakefield, Chapter IV ; Adam Bede, Mrs. Poyser's Kitchen ; Private Life of the Romans, Preston and Dodge ; Outlines, M. C. Ames, p. 200 ; Lippincott's Magazine, Vol. 2, p. 312 ; Cosmopolitan Magazine, May, 1899.

The School Kitchen

Boston School Kitchen, American Kitchen Magazine, Vol. 5, p. 211 ; Model School Kitchen, Vol. 6, p. 260.

Equipment. — The kitchen must be so planned and equipped that it will be easy to keep it (1) clean, (2) well ventilated and fairly cool.

1. (*a*) It should not be too large.

(*b*) The floor should be tiled ; or of hard wood, oiled, with all cracks filled with plaster ; or if the floor is an old one and of the kind impossible to keep clean without hours of labor, then cover it with linoleum. The use of a carpet cannot be defended.

No cracks should be allowed to exist either in the floor itself or, worst of all, at the junction of the mopboard and floor.

(*c*) All woodwork should be oiled and should be without ledges to catch the dust and dirt.

(*d*) The walls must either be painted or else covered with a washable paper.

(*e*) The sink should be of soapstone or else of iron, porcelain lined. If a wooden sink must be used, line it with zinc. Whatever the material, it must never be enclosed. The pipes must be in full view and painted white. For traps see the section on cleaning.

The sink should be broad at one end and there should be a draining shelf, inclining slightly toward the sink.

(*f*) Tables neatly covered with white enamel cloth save much labor; but their use necessitates several smooth, hard wood boards, or asbestos mats, on which to place the hot dishes used in cooking.

2. The kitchen windows should be large, easily opened above and below, and entirely screened. There ought to be other means of carrying off the odor of cooking. The modern kitchens make use of the laboratory expedient and cook under a hood ventilated into the flue of the chimney.

Furniture. — The range is the most important piece of furniture and should be the best possible. It is discussed in full later.

The cooking utensils are made of iron, of steel, of enamelled ware, of aluminium, of tin, of wood, of glass, of stoneware, of earthenware, and common crockery.

The advantage of iron and steel for cooking dishes is that they are not injured by a high temperature, and that they grow smoother with use; but they cannot be used in cooking foods containing an acid, — fruits, for example. They are heavy, too, and need extra care to keep them free from rust.

Enamelled ware, if of the best quality, is very satisfactory. The basis is iron on which is fused the enamel at a high

temperature. But do not be persuaded into buying "seconds."

Cheap tinware is poor sheet-iron plated with a thin layer of tin. This soon wears off and the iron beneath rusts.

Block tin, however, which is made of sheet tin, may be depended upon to wear well. It is expensive in its first cost, but economical in the long run.

The advantage of tinware lies in its lightness, and its disadvantage is that it melts at a comparatively low temperature. For this reason it should never be used for frying, nor put on the fire without having the bottom covered with some liquid.

Woodenware is light, but absorbs grease and odors. For this reason it should be used as little as possible. But there is nothing better for stirring than a wooden spoon.

Method. — As a preparation for the study of the kitchen, the girls might be required to bring in plans of the home kitchen, lists of the utensils, classifying them according to the materials from which they are made.

Exhibitions of various articles in bad condition will be useful, provided they are made a means of leading them to see the causes that have led to their destruction and the means by which it might have been avoided.

The object of this preliminary lesson is to interest the girls in the kitchen and to make them, unconsciously to themselves, study that room in their own house.

This chapter has been divided into two sections: the first of which deals with heat, combustion, fuel, fire, and the range; and the second with cleaning, including a slight study of plumbing.

SECTION I

Fire

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Fire. — Creation Myths of Primitive America, Curtin; Old Greek Stories, Baldwin (The Story of Prometheus); Open Fireplace in All Ages, Putnam; The Sun, Young; Text-book of Physics, Hall and Bergen; Chemistry in Daily Life, Lassar and Cohn; Organic Chemistry and Inorganic Chemistry, Remsen; Heating and Ventilating Buildings, Carpenter; Fire Worship, Popular Science Monthly, Vol. 10, p. 17; Public Opinion, Vol. 14, p. 251; Evolution of Methods of Heating and Cooking, American Kitchen Magazine, Vol. 3, p. 51; History of the Fireplace, Chambers's Journal, Vol. 3.

Heat

Facts: History of Fire. — Man has been defined as the cooking animal, as he alone seems to have produced heat by artificial means. Earliest historical records show that fire was known and used by primitive man, and to-day there is no tribe, however savage, that does not understand its use.

Early Egyptians, Persians, Greeks, and Romans had their public fire kept constantly burning, while in our continent the ancient Mexicans and Peruvians had their sacred fires on large pyramids. Early religions held the fire as a sacred symbol of the greater source of all heat, the sun. Greek mythology tells of the bringing of fire from the sun's chariot by Prometheus, and the punishment which followed the sacrilege. So sacred was fire that the priests or the vestal virgins, whose duty it was to watch the fires, were held in awe by the populace.

Theories of Heat. — Heat was at one time considered a material substance which might enter into or depart from a body, and the terms which to-day are used in discussing heat were based on this erroneous idea of heat's material existence.

Nature of Heat. — It is now believed that every physical body consists of a mass of minute particles, individual, invisible, called molecules, which are in a state of constant motion, and that a rise in temperature is accompanied by an increased motion and consequent friction among these molecules.

By friction of one body upon another we may so set up motion in these particles that the temperature will be increased as shown by the melting of ice when one piece is violently rubbed upon another, or by the heat manifested when one piece of wood is rubbed briskly against another.

Temperature. — The rate of motion of these particles is proportional to the intensity of the heat. This heat intensity may be measured by a thermometer and is called temperature. There will be a heat not sensible by the thermometer, and known as latent heat. Because of this latent heat the temperature of a body does not indicate the amount of heat contained in it any more than the height of a body would alone determine its weight.

Latent Heat. — The amount of latent heat is dependent on the property of the body to absorb heat without showing any change in temperature. As an example, may be noted the heat necessary to evaporate water by rapid boiling while all the time the temperature of the water remains unchanged. The radiant energy of the sun — supposed to be the source of all possible energy in matter, may be shown by concentrating the sun's rays on white paper by means of a convex lens; and noting the charred effect or even the flame produced if the sunshine is bright enough.

It is computed that were the sun to be extinguished, all terrestrial life, in less than a month, would cease to exist. This radiant energy, coming as it does in waves produced by molecular motion in the ether, is stored up in animal and vegetable life to be liberated when consumed either as food or as fuel.

During this consumption the compounds are changed into much simpler products, potential energy being liberated as work or as heat.

Method. — Discuss the source of all heat — the sun.

Experiment 1. Rub two sticks together briskly or rub two pieces of ice together.

Experiment 2. Place cold water in a large flask. Drop into it a cube of litmus or a crystal of potassium permanganate. Apply heat from underneath. The flask may stand on asbestos mat over gas flame. Let the pupil watch the motion in the liquid.

Experiment 3. Apply cloth wet in boiling water to neck of bottle, in which a glass stopper is tightly fitted, or loosen cover of Mason fruit jar in same way.

Experiment 4. Concentrate the sun's rays with convex lens upon black paper or paper smoked by gas or candle flame; concentrate rays upon white paper. Note the effect on each. Explain the absorbing power of lampblack or any other black substance.

Experiment 5. Apply heat from gas flame to one end of brass or steel wire on which, at regular intervals, are fastened small shot held in position with warm paraffin. As the heat is transmitted the melting of the fat causes shot to fall.

Let the pupils perform these experiments individually if this is possible. Be sure not only that they see the result, but also that they understand the deductions to be made from these results, and above all the general principles thus illustrated.

Combustion

Facts. — The liberation of energy when accompanied by the evolution of light and heat, or heat alone, is known as combustion. In the restricted sense combustion is produced whenever the oxygen of the air unites with another element or compound with consequent evolution of heat. The heat

and light obtained from combustion is a result of oxidation of carbon or hydrogen or both. These, therefore, are the essential elements in fuels. The oxygen present in some fuels, as in wood, is inert in the sense that it may not take an active part in the production of heat.

Since as far as is known nothing in the physical world is ever destroyed, during this consumption of fuel new combinations of the elements hydrogen and carbon with the oxygen of the air must be formed and pass off as simpler and usually invisible compounds. Smoke, which often accompanies combustion of carbon, is not a compound, but carbon in a finely divided state — a result of deficient supply of oxygen, and hence due to lack of perfect oxidation.

Products of Combustion. CO_2, CO, H_2O. — When the union of carbon with oxygen is not restricted by a limited supply of air, the resulting product is carbon dioxid, formerly called carbonic acid gas. When the supply of air is very limited, the product formed is carbon monoxid — a very poisonous gas. It is formed in hard coal stoves whenever the air supply is restricted by closing the drafts and may be seen in a state of combustion as pale blue flame hovering over the glowing coal. Carbon monoxid is also a part of what is known as water gas. The union of the hydrogen in the fuel with the oxygen in the air produces water, which as water vapor passes with the other products of oxidation into the atmosphere.

Hydrogen. — Hydrogen ignites at a much lower temperature than carbon, about 300° F. The heat of the flame produced is great, but there is almost no light produced.

Carbon. — On the other hand, carbon when ignited glows but does not produce a true flame, at most only a blue flame, which may be due to the oxidation of carbon monoxid into carbon dioxid.

When the two are burned together they produce a lumi-

nous flame, the light being due to the incandescent condition of finely divided carbon. This may be shown by holding a piece of porcelain in the flame of a candle or by sifting powdered lampblack or charcoal into the flame of the Bunsen burner. Hence flame to give light as well as heat must be produced by a fuel containing carbon and hydrogen.

Ash. — Aside from smoke, solid fuel leaves another visible residue known as ashes or ash. Ash is composed of mineral matter taken from the soil by the vegetation during growth. It is a very poor conductor of heat, absorbing it in large quantities. Smoke has the same effect, hence their presence is detrimental if great heat is to be radiated. The effect of retention of heat by ashes may be illustrated by cooking an egg or a potato by burying it in the hot ashes. The lack of conducting power may be shown by placing cool ashes on the palm of the hand so that it will be thickly covered and then placing a live coal upon it.

Essentials for Combustion. — There are three essentials for perfect combustion: —

I. A supporter of combustion.

II. A combustible.

III. Sufficient heat to cause a union between the combustible and the supporter of combustion.

Supporter. — The supporter of combustion is nearly always oxygen as found in the mixture air. The other constituents of air are all inert substances retarding combustion, or when present in excess preventing it. Hence the necessity of removing exhausted air and the products of combustion as soon as formed. Their deadening action is utilized in chemical fire engines. A larger proportion of oxygen in the air would render life very much less safe. "Spontaneous combustion" would then be the rule rather than the exception.

Method. — Combustion.

Material. — Candle, glass rod and tube, lime water.

A. Historical Data.

(*a*) Mythological stories.

Greek.

American myths.

(*b*) Remains of prehistoric man.

(*c*) Methods of ignition.

Friction or striking flint.

B. Chemistry of Combustion.

Experiment 6. Let each pupil observe the combustion of: —

A common match.

A parlor match.

A safety match.

And then tell what she has observed as to production of flame, method of burning, as well as odor. See the account of matches under the section on fuels. Light a long splint and insert it into a dry test-tube. Let pupils tell the reason for the flame being extinguished.

Essentials for Combustion.

(*a*) A combustible.

(*b*) A supporter of combustion.

(*c*) Heat.

Composition of Air.

Experiment 7. Invert an empty bottle over a lighted candle standing in a dish of water. Let the mouth of bottle rest below the water. As air in bottle has its oxygen exhausted by the burning candle, the water rises to take its place. By withdrawing the candle without moving the bottle, and then slipping a piece of glass over mouth of bottle, it may be inverted, retaining the water which has replaced the oxygen or part burned out. By measuring the water and then measuring capacity of bottle.

the ratio which supports combustion may be shown.

C. Flame.

Experiment 8. Examine parts of a Bunsen burner, apply heat from heated wire to ignite the gas.

(*a*) Carbon or yellow flame.

Study parts of carbon flame.

Hold cold porcelain in yellow flame and examine the deposit.

Save deposit for next experiment.

(*b*) Oxygen or blue flame.

Note parts of flame.

Sift into flame part of black deposit from preceding experiment.

Draw conclusions as to cause of color and of light in carbon flame.

Composition of Blue Cone.

Experiment 9. Place one end of glass tube in blue cone of oxygen flame. Apply lighted match at the other end and note color of flame produced.

Difference in Heating Power.

Experiment 10. Hold one end of glass rod in carbon flame and note length of time required to raise it to red heat.

Hold the other end in oxygen flame.

Compare results.

Explain and state which flame is to be used in cooking.

D. Products of Combustion.

Experiment 11. Water. Hold cold porcelain or granite ware in blue flame of Bunsen burner for a minute. Note the moisture on the surface of dish. (Part of moisture is doubtless due to water in the gas.)

Carbon Dioxid [CO_2].

Experiment 12. Light a pine splint, and when it is burning briskly lower the flame end into a dry empty bottle and partly cover the mouth with a cardboard. Let the pupils note the effect upon the lighted splinter.

Remove the splinter and add lime water to the bottle, shake and again examine.

Experiment 13. Let pupil breathe through glass tube into lime water and see if results are similar.

Explain necessity of removing CO_2 in both cases.

Fuel

When the combustible element or compound is cheap, it is known as a fuel. A fuel is usually carbon or a compound of carbon.

Fuels may be divided into solids, as coal, wood, and products derived from them, as charcoal and coke; liquids, as petroleum and its products, methyl and ethyl alcohol; and gases, as natural gas, coal gas, water gas, and acetylene gas. Or they may be divided according to probable origin, as follows:

I. Vegetable fuels, as wood, and products of wood distillation, as methyl or wood alcohol, and charcoal.

II. Mineral fuels, as coal, subdivided according to composition into peat, lignite, cannel coal, bituminous and anthracite; and products of coal distillation, as coal gas, water gas, and coke.

III. Mineral oils and gases, as crude petroleum, from which are derived naphtha, gasolene, benzine, kerosene, and natural gas.

IV. Product of fermentation known as ethyl alcohol.

Wood.—Wood, or vegetable fibre, is composed largely of

a carbohydrate, cellulose, which forms the cell wall of all plant life. It belongs to the carbohydrate group because of its composition; but man cannot use it to any extent for food, as he does most other members of the group. See chapter on Starches.

Associated with the cellulose in wood are varying amounts of nitrogenous matter, resins, and coloring matters, as well as the mineral products which remain as ashes after combustion. In its pure state cellulose may be found in the form of Swedish filter paper. Less pure forms are cotton and linen.

Though formerly wood served as the chief fuel, now in the cities it is used mainly as kindling and in fireplaces.

Kinds of Wood.— In the markets, wood is roughly classed as either hard or soft.

Soft Wood. — The soft woods, as pine, spruce, fir, hemlock, cedar, and red wood, because of lighter, more spongy texture and large amount of resin, burn very freely, producing a quick, hot fire. They are therefore largely used as the kindling in coal stoves or ranges. The charcoal formed from soft wood is soft and crumbly.

Hard Wood. — The harder woods, as oak, hickory, ash, chestnut, maple, birch, poplar, elm, and walnut, are much more dense in structure, contain no resin, and therefore require a higher degree of heat to ignite and are consumed more slowly, thus giving out heat for a much longer time. Because of the small amount of flame produced by combustion of these woods, and the large amount of charcoal formed, they are used in culinary operations where live coals are desired.

A careful study of their woody structure, and of their condition in the way of dryness, freedom from decay or presence of insects, will aid the investigator in gaining information of economic value. If the wood is damp, then

in the change of the sap or water into the form of vapor much heat becomes latent and is wasted, from a culinary standpoint. In the beginning of combustion of wood, during the flame stage, all of the hydrogen and part of the carbon pass off as water and as carbon dioxid, and much heat goes with them, the greater portion becoming latent in changing the water to steam. In the second or glowing coal stage, the waste product is carbon dioxid, which carries off little heat. Therefore the greater the proportion of carbon in the wood, the higher its heating value.

Charcoal.—Wood, when subjected to excessive heat without free access of air, gives up first of all its hydrogen and part of its carbon, mostly in the form of flame. The remainder of the carbon is in the form of glowing charcoal. This charcoal is formed in greater or less amounts in all wood fires. If wood be subjected to heat without access of air, the hydrogen and other volatile products are driven off, leaving almost all of the carbon in a free state. The supply of charcoal in the market is prepared in specially constructed kilns, so arranged that, besides producing charcoal, the volatile products of wood distillation are retained.

One of these products is known as methyl, or wood alcohol. As a rule, the denser the wood the greater the proportion of carbon and the more valuable the charcoal made from it, providing the charcoal is for use as fuel and not for use in the arts. Good charcoal is firm, free from dust, and should break across the fibre with a shining fracture. Charcoal is burned in warmer countries in portable stoves or fire-boxes, unprovided with either chimney or draft. These fire-pots are set in the upper part of crude masonry, thus forming a primitive range, each fire being separate. In this country charcoal is used to produce heat for broiling.

The making of charcoal may be illustrated by heating

pine splints in a test-tube and noting the products which are driven out of the wood and the condition of residue.

Methyl alcohol, though belonging under head of wood products, will be discussed in connection with the topic ethyl alcohol.

Mineral Fuel.— Coal is, as far as known, vegetable growth transformed in the past ages in some way by heat and pressure into a product richer in carbon and less rich in inflammable gases than wood. To judge from results, the process must have been one of slow distillation.

Coal is found in certain geological formations, and only within certain limits is it within reach of man. These regions are known as coal fields. From these mines coal is transported to all sections of the country.

Peat.— In our own day the beginnings of this change from plant growth into coal is shown in peat formation, where remains of plants in bogs or on the borders of shallow pools fall and are covered by water and vegetable pulp which exclude the air. This, in connection with other factors, prevents natural decay, and hence the mass continues to accumulate, becoming more dense from year to year. This partly transformed product is cut into thin oblong blocks, which are dried in the sun and used somewhat as coal is used. The flame produced, because of excess of hydrocarbons, is smoky and disagreeable.

For household use, coal is divided into the following kinds: peat, lignite, cannel, bituminous, non-bituminous, semi-bituminous, and anthracite.

Lignite.— Lignite is that coal formation which still retains evidence of woody structure. It is usually brown in color, but is much nearer true coal than peat is.

Cannel. — Cannel coal contains a very large proportion of hydrogen in the form of hydrocarbons, therefore burning with a bright flame. It is usually dull black in color, and

comes in compact, slablike pieces. It is found in not many places in this country and, hence, is expensive. What is found in the market under that name is a semi-bituminous coal.

Bituminous. — Bituminous coal is found in eastern United States and, to a small extent, in the West, but the mines in that section produce what is known as non-bituminous coal. In appearance bituminous coal is compact, but inclined to break into irregular fragments with bright shining fracture. As the name implies, it is pitchy in character, but this does not become apparent till during the process of combustion, when it seemingly partially melts, and gas escapes from the mass until the remainder is almost pure carbon. For this reason it is sometimes called caking coal. In the manufacture of coal gas this caking portion is known as coke.

Non-bituminous coal resembles bituminous coal in appearance, but lacks the property of forming a fused mass in burning, hence, cannot be used to produce coke. Both produce much flame and smoke in burning, hence are objectionable on ground of cleanliness.

Semi-bituminous coal lies in formation between bituminous and anthracite, possessing some of the characteristics of both, burning with much less flame than bituminous, but more freely than anthracite. Being fairly free from hydrocarbons it is a cleanly fuel, and is often used for ranges and fireplaces. It stands next to anthracite in fuel value.

Anthracite. — Anthracite coal is the most compact of all the coals, being almost free from hydrocarbons and, therefore, burns with a slight, blue flame. Unless very expensive this coal is the most satisfactory and economical because of its greater heating power per ton, and because of its more uniform combustion. It is cleanly and easily used because of uniform size of the fragments.

Coke, like charcoal, is one of the resulting products of

distillation. It is coal heated without access of air, so that all the hydrocarbons may be driven off. For use in the arts coke is prepared by heating bituminous coal in special coke ovens. It is the equal of anthracite coal as a source of heat. Gas coke, the residue left on heating bituminous coal and cannel coal in the manufacture of coal gas, is largely used for household fuel. It is not equal to anthracite in fuel value. Because of its cleanliness, it is preferable to bituminous coal, though it is thought by some to burn out grates and fire-boxes more rapidly than other fuels.

Coal Gas is almost a pure hydrocarbon, and is prepared by distilling any coal rich in hydrogen. Under the subject of coke the coals most used were mentioned. Of all the gases used this is the most perfect in its results.

Water Gas. — Though anthracite coal cannot be used in the making of coal gas, it is used in the manufacture of a gas which, because the hydrogen and oxygen it contains are derived from water, is known as water gas. Water, in the condition of superheated steam, and vaporized naphtha are passed over glowing anthracite. The carbon of the coal has a great attraction for the oxygen in the water, and in this heated condition they recombine to form equal volumes of carbon monoxid and free hydrogen. Water gas, even when enriched by naphtha, is not a good gas for either lighting or heating, being inferior to coal gas. The most serious objection to its use is on the ground of health, as the carbon monoxid is a deadly poison, "uniting with the hæmoglobin of the blood to the exclusion of the oxygen. A small percentage of it has proved fatal." Coal gas suffocates by reducing the amount of oxygen in the room, but it is not a poison in the sense water gas is.

Mineral oil, or crude petroleum, is a hydrocarbon, similar in composition to coal oil, which is a crude oil distilled from coal. Nevertheless, petroleum wells seem to have no direct

connection with the coal in the earth. Whether it has passed upward through sand or shale strata during coal distillation and, hence, is not in direct connection, has not been satisfactorily proved; but geologists generally agree that petroleum has been derived from vegetable remains which existed in past ages. The crude product has been known for centuries. The sacred fires of the Persians are burning oil springs. It was not till 1859 that it was discovered in large quantities in western Pennsylvania.

Petroleum is obtained by boring in the same way artesian wells are sunk. The dark crude oil flows or is pumped from the earth and may be used, and is used to some extent in the arts as fuel, but for household use it is subjected to fractional distillation called refining. During refining, gases, liquids, and solids are obtained.

Naphtha is the product which distils between the temperature of 40°–70° F.

Gasolene between 70°–90°.

Benzine between 90°–150°.

Kerosene between 150°–280°.

Lubricating oils between 280°–400°.

The residue contains vaseline, paraffin, and tarry matters. Of these gasoline and kerosene are used as household fuels.

Gasolene is largely used as a source of gas in private houses not connected with a city system. When allowed to mix with air in its passage from a receptacle to the burner it forms what is called air gas, used in all forms of gasolene stoves. If the gasolene and air are mixed in specially constructed apparatus away from the dwelling, and then conducted in pipes to the place where it is to be used, a very good fuel may be obtained. Its lighting and fuel value are below that of coal or natural gas.

Kerosene should never contain hydrocarbons which ignite at a temperature below 135° F. The better grades should

not "flash" till warmed to 150° F. Some states require a flashing point of 200° F. It is a question whether the housekeeper should apply the standard test herself or trust to the dealer. Miss Parloa advises filling a cup one-quarter full of cold water, inserting a thermometer, and then adding boiling water till the temperature reaches 110° F. At this point add two teaspoons oil and with a lighted taper try to ignite the oil. If it takes fire, it is not safe.

Kerosene of a high standard is in the end more economical even though more expensive, as it is more even and lasting in its combustion.

Natural gas is a hydrocarbon similar but not equal in value to good coal gas. It is obtained by boring in the same way petroleum wells are bored. Though not associated together in the earth, the general conclusion is that coal, petroleum, and natural gas must have a similar origin. In regions where it is found, natural gas is used for heating, lighting, and cooking, proving a very ideal fuel.

Acetylene gas is not a natural product, being made artificially by action of water on calcium carbid, CaC_2. It burns with an intense white light; but at present its use as a fuel is problematical, as it has proved, under perhaps careless use, very explosive. Some authorities state that there is some acetylene gas formed in the inner cone of gas and candle flames, and that light is largely due to its presence.

Alcohols. — Besides the wood alcohol which is produced by destructive distillation of wood, there is a second alcohol produced by fermentation. This alcoholic product of fermentation is called ethyl alcohol or spirits of wine. Both alcohols are very volatile and should be closely stoppered. They burn with a faint blue flame, producing a fair amount of heat. They may be used in chafing-dish burners as well as in lamps. The objection to wood alcohol is that

often there is an unpleasant odor connected with its use, and it is thought to be a poison, hence is used only as a fuel, never as a solvent in food or medicine as ethyl alcohol may be used.

Alcohol may be burned through a wick or from an asbestos pad. The later method is wasteful, as if any alcohol is unused it cannot be saved.

Method. — In oral language lessons and in reading give the children the history of such of these fuels as are used in their own homes. Secure from them and for them specimens for study and exhibition. Lay special emphasis on the comparative fuel value and cost of these materials, letting them deduce these facts from their own observations and experiments.

The Range: Theory, History of its Evolution, and Practical Work

Kindling Point. — At ordinary temperatures very few substances unite readily with oxygen, but require a very high degree of heat before chemical union can take place. This degree varies with each substance and is known as its kindling point.

Because of its extremely low kindling point, phosphorus is used in the manufacture of matches. The ordinary match is a splint of wood, one end of which is dipped in melted sulphur and then tipped with a paste of phosphorus, potassium nitrate, or potassium chlorate and glue. Coloring matter may be added to the paste. If potassium chlorate is the oxidizing agent, the match snaps and burns vigorously when friction is applied. This union of the phosphorus with the oxygen, which is loosely held by the oxidizing agent, produces enough heat to ignite the sulphur. The heated sulphur unites with the oxygen of the

air, forming sulphur dioxid, odor of burning sulphur match. The burning of the sulphur in turn ignites the wood.

Safety matches do not contain phosphorus, but in place of it antimony sulphid is used. The ignition is produced by scratching upon a special surface coated with red phosphorus and sand.

The ignition of the match gives a fair illustration of the steps in the production of all flame from fuels; namely, a product rich in hydrogen and carbon, a fair amount of oxygen, and a temperature sufficiently high to cause separation of the hydrogen and carbon compounds into their elements, and a reunion with oxygen to form the simple compounds water and carbon dioxid.

In historical and comparatively recent times the production of igneous combustion was a serious problem, as heat sufficient to ignite even the most finely divided fuel, as tinder, could be provided only by striking steel against flint or pyrite, or even rubbing two sticks together vigorously. Now the problem is much simplified, as the friction on the match causing it to ignite furnishes heat enough to ignite paper or finely divided wood or shavings.

Gas, oil, or semisolids are largely composed of hydrocarbons, which when heated to their kindling point unite with the oxygen of the air forming water and carbon dioxid. If the supply of oxygen is not adequate, the elements form free hydrogen, marsh gas (CH_4), and carbon monoxid, besides, leaving some carbon in a glowing state. This glowing carbon is what gives the yellow color and furnishes light in the candle and in the carbon flame. The heat generated by the burning wick in the candle melts the fat (paraffin or stearin), and this liquid being drawn up through the fibres in the wick is slowly changed from liquid to gaseous state, and as the gases expand they pass to the outer portion of the flame, there mingling with the air and being heated to igni-

tion point unite with the oxygen to form carbon dioxid and water. In the second cone the proportion of oxygen being small part of the carbon, though heated to the glowing stage, does not form a chemical union till it reaches the outer cone. The light is due to incandescent carbon particles.

This change from liquid to gaseous state is true in the case of oil combustion, hence the wick in either lamp or oil stove should be loosely woven and fitted perfectly without crowding or excess of air space in burner, otherwise air passing into the partly filled receptacle and mingling with the gas formed may ignite, causing an explosion. This explosion in miniature occurs when the tube of a Bunsen burner becomes heated and "catches back," that is, ignites at lower orifices. This occurs when gas is turned very low and there is not enough pressure to force the gas rapidly upward through the tube.

Perfect Combustion. — The quantity of oxygen required to produce perfect combustion with most even production of heat theoretically has been demonstrated with carbon and with hydrogen separately. The results seem to show that excessive supplies of air are very wasteful of heat, for though the fuel is entirely consumed a large percentage of the heat liberated passes up the flue with the excessive draft. If not enough air passes into the burning fuel part of the carbon passes off as smoke, which is not only wasteful but actively detrimental, as the smoke collecting in the flues interferes with the circulation as well as prevents proper conduction of the heat. The quantity of air is regulated by openings in the apparatus, and a little experience and watchfulness soon demonstrates the proper control of these openings.

Evolution of Cooking Apparatus. — Probably primitive man, like his prototype to-day, cooked his food before or over the open fire or buried it in the hot ashes and glowing embers

as is done by campers. References in Homer seem to indicate that even then the cooking of meats was before the open fire and not in a pot suspended over the coals. It is probable that coating fish or fowl with wet clay or mud, and then covering them with live coals, first suggested the possibility of making a permanent covering and resulted in the making of crude pottery as well as the crude ovens which were heated by being placed in the hot ashes and the top covered with live coals, much as the Dutch ovens were and are used now.

The modern baking apparatus, however evolved, is arranged for the use of coal, oil, or gas, seldom for the use of wood only. The modern range may be so constructed that by changing the parts in the fire-box any of the fuels may be employed.

Electricity. — The latest form of apparatus is heated by means of the electric current. The objection to this apparatus is its excessive cost. As far as the heat for cooking is concerned, the cost of heat obtained directly from the coal is more than that derived from the electric current, for, though in transforming energy liberated by burning coal into electrical energy available for heating, only about four per cent is applied, practically all of that is utilized in the cooking apparatus. On the other hand, of the total amount of heat liberated in the coal range only one * per cent is utilized in cooking. Comparing the cost of the electric current used in lighting with gas used, when the cost for electricity is ten cents per thousand watt hours, it is about equivalent to gas at $1.25 per thousand feet. Considering that in the gas stove much heat liberated is not used, the obvious conclusion seems to be in favor of the use of electricity. If the apparatus is ever constructed so as to be sold at reasonable price, then electricity as a

* "Heating and Lighting." — CARPENTER.

source of heat will stand first in the list for use in cookery. Under present conditions coal will be used for a long time to come.

Range. — A good range should answer to the following: —

(1) drafts as nearly perfect as possible;
(2) checks and dampers arranged so that the cook may control rate of combustion at will;
(3) large oven space for size of range;
(4) evenness in temperature in all parts of the oven;
(5) arrangements for broiling;
(6) fire-box large enough to admit coal to depth of seven inches.
(7) * Top part of stove all available for cooking at boiling temperature;
(8) double shaker, so that grate may be cleaned easily (duplex grate is good);
(9) hot water back so arranged that a large supply of hot water is always available.

Gas Range. — Gas range should occupy a small floor space, and yet the following be true: —

(1) oven large;
(2) good place for broiling;
(3) room on top for heating several products at once;
(4) one or more small burners, so that gas may not escape by using a large burner with gas turned partly off, as otherwise must be done while simmering.
(5) pipe connecting with chimney to remove products of combustion.

Loss of Heat. — The loss in heating power available from a range is largely due to nature of heat itself, but in a measure is due to faulty construction, improper material, and lack of intelligent attention to obvious details on part of user.

* Culinet Range.

A review of the subject will aid in drawing important conclusions. "Heat passes from a warmer body to a colder by three general methods, — radiation, conduction, and convection."

Radiation. — Radiant heat passes in waves directly in straight lines from the heated surface till absorbed by some body in its path. Air, except that containing large amount of water vapor, does not absorb it. Radiant heat may be reflected from metallic surfaces, but is transmitted by certain substances, as glass and liquids. Being received directly from the source, radiant heat is of a high temperature. The amount of heat radiated from a body depends upon the nature of the surface only. Experiments have shown that when the surface is highly polished, varnished, or enamelled the radiation is lessened.

Conduction. — When one end of a bar of metal is held in the flame, the heat travels slowly through the length of the bar, producing a rise in temperature. It differs from radiant heat in that its passage is gradual, and not affected by change of direction in substance heated. After a certain temperature is reached, the body begins to transmit heat. This method is called heat transmission by conduction. The amount of heat conducted depends on the material and on the diameter of the body. Metals conduct heat very easily, though they vary among themselves.

Convection. — When the minute particles, or molecules, of which bodies are composed, in their vibration, come in contact with hot bodies, they will themselves become warm. It is in this way that gases and liquids are heated. Air in a room, or in a tightly closed space like an oven, is heated by coming in contact with heated surfaces, the currents in the air keeping the temperature more nearly equal. In heating water it is the circulation, depending upon the difference in temperature of various parts, which, by bringing every par-

ticle in contact with the heated surface of the dish, causes the water to become hot. This method of heat transmission is called convection, or heating by contact. Most cooking is done by heat transmitted by convection.

In any cooking apparatus, then, loss of heat occurs when the material presents a rough, unpolished surface, has many projecting portions (ornamentations?), or is placed where currents of air may strike it. For economy of heat all cooking apparatus must be highly polished or enamelled, free from all but essential projections, and so placed while in use that no drafts may cross or strike it. In ovens, non-conducting material, as asbestos, may be used between sheets of iron or steel, further to prevent loss of heat. This is done in the Aladdin oven and in some steel ranges.

Care of Range. — Every morning clean the ashes from the top of the oven, leaving a very thin layer to act as a non-conducting medium and so prevent excessive top heat in the oven. Close all drafts and shake the ashes out of the grate into the ash pan. If there is an ash sifter above the ash pan sift the ashes to save unburned coal, otherwise the ashes must be sifted later when they are removed. Carefully remove all ashes, as if left they absorb heat and are wasteful. Return ash pan to its place, save unburned coal for use on fire when well burning. Brush any remaining ashes into ash box and remove clinkers.

Laying Fire. — Crush paper and place in empty fire-box, lightly place on this finely split wood laid like lattice work, on this arrange a second layer of slightly larger kindling which should be of hard wood. Replace covers and light the paper from underneath. See that all dampers are open and checks closed. When the wood begins to burn, in about three minutes, add two shovelfuls coal so placed as to rest on the burning wood. When this ignites add coal to fill the box to within one or two inches of the covers — never above

top of oven, otherwise there will not be air space to cause a draft. In few minutes, five usually, depending on strength of draft, close the smoke damper so as to send the heated air around the oven and up the chimney. Keep the lower draft open till the coal begins to look red in a few places, then close all drafts. This fire should need no further attention for several hours. When the coals are all red, but not beginning to look white, add a fresh shovelful of coal so that the oven may not be cooled, but be kept at a steady, even heat. In an ordinary school kitchen range in constant use for five hours, two hods of coal should last three days.

In case the oven is too warm, open the check in the pipe that connects the range with the chimney flue. If this is not effective, open the slide which is in the front of the range at edge of the fire-box, thus letting cold air enter and retard combustion by cooling the fuel.

To revive a fire, shake the grate which cuts the ashes from the bottom of the fire, or in case this is absent remove the ashes at the bottom by using the poker; never shake down a fire as this packs the coals, leaving too little air space for perfect combustion. Heating the top of the range to redness not only tends to warp the covers, but by producing heat sufficient for oxidation actually burns out the iron.

To clean the Range. — After the fire is laid, but before it is lighted, wash the top of the range with warm soap-suds, wipe dry, and with a dauber apply a mixture of powdered graphite and soapy water (stove polishes have graphite as basis) to all parts not highly polished. Rub to dull finish with the blacking brush, then light the fire, and as the iron becomes warm polish every part of the iron with a stove mitten. No blacking will rub off on the cooking utensils if the work has been well done. During the day keep the top of the range clean by rubbing with soft paper.

If any of the parts of the range are unfortunately of

nickel, these should be polished when cold by covering with a whiting mixture, leaving till product is dry and then polishing with a soft cloth.

Brass trimmings are best cleaned with a mixture of rottenstone and oil, or the oil may be placed on the cloth and then dipped in the powder. This polish gives a soft yellow color which is very lasting. The brass polishes in the market have oil and rottenstone as a basis, but usually contain either an acid or an acid salt which acts on the surface of the metal. Their use should be followed by polishing with whiting.

Method. — 1. Chemistry of matches including kindling point experiment.

2. Flame, study and draw.
3. History of cooking apparatus.
4. Study of coal range.
   (1) Drafts, make drawing of range showing flues.
   (2) Cleaning the fire-box.
   (3) Placing the kindling.
   (4) Polishing the range.
   (5) Lighting the fire.
   (6) Keeping the fire constant.
   (7) Sifting of ashes and use of cinders.

Home Work. — Study home range and prepare drawing of parts showing air-spaces and drafts; essay on combustion and care of fire.

SECTION II

Cleanliness

Chemistry of Cooking and Cleaning, Mrs. Richards and Miss Elliott; Chemistry in Daily Life, Lassar and Cohn; Organic Chemistry and Inorganic Chemistry, Remsen; Handbook of Household Science, Youmans; Household Economics, Miss Parloa; Home Sanitation, Mrs. Richards and Miss Talbot; Women, Plumbers and Doctors, Plunkett; Dust and its Dangers, Prudden; Story of the Bacteria, Prudden; Story of Germ Life, Conn.

Chemistry of Cleaning

The metals in use in the kitchen include iron or cut steel, brass, copper, tin, zinc and aluminium, nickel and silver. Under the head of composition are found glass, porcelain, granite, and enamel ware.

Iron. — If iron has not been exposed to dampness and is not rusty, washing with hot soap-suds or weak sal soda water and rubbing dry with a cloth is all that will be required. Iron sinks that are rusty may be cleaned by rubbing the inside with mutton fat, free from salt, and sprinkling with powdered quicklime. Leave over night and in the morning wash with plenty of water and a brush. Thoroughly rinse with sal soda solution and then with clear hot water. Rust may be removed by scouring with powdered emery cut with benzine. This must be used on a cold surface.

Brass and Copper. — Brass or copper are readily acted upon by acids, hence they should not be used if any other method is possible. See care of range for details of methods.

Tin is easily acted upon by acids, less easily by alkalies. In cleaning a discolored tin rub with baking soda moistened, or use a weak solution of sal soda, rinsing thoroughly in warm water and polishing with a dry soft towel.

Zinc surfaces may be cleaned with whiting used as a polish.

Aluminium, nickel, and **silver** all scratch easily and are therefore most satisfactorily cleaned by using whiting paste made as follows: Sift jeweller's whiting through a fine meshed cloth to remove any hard particles which might scratch the surface. Make the sifted whiting into a paste with soapy water, or water and alcohol, or water and ammonia. Apply the paste evenly to the clean surface of the metal. Let it dry and then polish with a very soft cloth. Silver should receive a last polishing with chamois.

Silver may be cleaned weekly by being allowed to stand in weak ammonia water for one-half hour, then rinsed and polished. Plated ware may be acted upon by strong alkali solutions. Silver should not be polished with whiting oftener than once a month.

Glass. — Common window glass is easily acted upon by alkalies or acids, hence they should not be used in any but very weak solutions. Cover with a paste made of whiting. When it is dry, polish with soft paper. There are various cleaning preparations or soaps found in the market which act well used in the same way.

Porcelain. — Remove all debris and wash in clear soapy water; rinse in warm water, never in boiling; place in rack so they will not touch, and, when drained nearly dry, polish with soft cloth.

Granite Ware. — Do not use a knife in cleaning either granite ware or blue enamel ware, but remove any food which will not soak off, by rubbing with iron dish-cloth and then scouring with sand soap. Wash in warm soap-suds and rinse in clear hot water. Wipe dry on soft towel.

Grease. — The solvents of grease which may be used in cleaning are kerosene, gasolene, benzine, naphtha, ether, and chloroform. Of these kerosene is used in cleaning utensils which may be oily. Add one tablespoon to the warm water and wash the dish, rinse twice, and then dry. When used on finished woodwork to remove greasy vapors, it must be rubbed dry each time. Alkalies, as ammonia, caustic soda, or caustic potash, form soaps or emulsions with fats, the alkali uniting with the fatty acid of the fat, setting the glycerine free. Sal soda, Na_2CO_3, is an alkaline salt which has a similar though less marked effect. It is used in all cases where the amount of fat is small. Heat aids the formation of a soap, hence these alkaline solutions should always be hot when used. All

kitchen utensils should be put to soak as soon as used, so that when time comes to wash them, no food is dried on. Wash in hot soapy or soda water, rinse, and wipe dry. Never leave the dish stained or blackened, but wash as carefully as the china is washed. Begin with the tin utensils, then granite ware, and last iron ware.

Care of the Sink. Disinfectants. — After the dishes are all washed with fresh soapy water, wash the sink in all its parts, leaving no corners in which dirt may collect. *Never* pour *greasy water* down the sink drain, but first change it into a soap or dissolve it. All dish water *must* be poured through a fine sieve to remove any coarse particles.

Three times a week the sink drain should be flushed with a boiling sal soda solution, one pint sal soda dissolved in three gallons water. Use at least two quarts, following a flushing with very hot water, so that any grease which may have collected will be in a liquid condition, and so will be changed to a soap or emulsion more quickly.

Lint from dish-cloths which are very much worn often clog a sink trap, and should not be used for that reason. In the lower portion of every trap there should be an opening closed by a screw cap, so that if drain through careless use becomes clogged, a pail may be placed under the trap, the cap removed, and the trap thoroughly washed and disinfected. The terms "disinfectant," "antiseptic," and "deodorant" are used so loosely that it may not be out of place to define them.

"An antiseptic arrests putrefaction or fermentation, but does not kill the micro-organism, whilst a deodorant is used to destroy bad odors from cesspools, stables, and discharges, etc. . . . By term 'disinfection' is meant the absolute destruction of infectious material."

Chemical.	Antiseptic Proportion.	Disinfectant.	Deodorant.
Bichloride mercury . .	1 : 40,000	1 : 500, 1 : 1000	—
Permanganate of potash,	1 : 3,000	Saturated solution	1–3000
Boric acid	1 : 200	—	—
Carbolic acid	1 : 500	1 : 20	1– 50
Sulphate copper . . .	1 : 400	—	1– 400
Sulphate iron	1 : 200	—	1– 400
Chloride of lime . . .	—	25 % chlorine	1 lb. to 8 qts. H_2O
Chloride of zinc . . .	—	1 : 5	1– 20
Milk of lime	—	Used as whitewash	—

Boiling water is an antiseptic if temperature is maintained ten minutes.

Boiling hot soap-suds is another excellent antiseptic.

To be of value, a disinfectant must touch all parts of the object thought to be infected, so that no germ life may escape.

All woodwork and walls where dust may collect and germs develop should be washed in an antiseptic solution and then in clear water and wiped dry.

Sunshine is detrimental to growth of germ life, and hence is a fair antiseptic, but for hygienic cleanliness its work should be supplemented by use of antiseptic washes. All antiseptic or disinfectant solutions should be carefully labelled *poison* and placed in a locked closet to prevent accidental poisoning.

Method. — Outline.

Materials. — Mouldy food, test-tubes, flour, sugar, alkalies, beef fat or olive oil, whiting, rotten stone, emery, benzine, kerosene.

A. Meaning of Cleanliness.

Includes: —

I. Removing dust.

II. Preventing growth of germ life.

III. Removing stains.

B. How Accomplished.

(*a*) Floating products in air allowed to settle and then removed by wiping surface with cloth dampened in water, soapy water, or mercuric chloride, water solution 1 : 40,000.

Wash cloth, using hot soap-suds, and rinse in boiling water. Dry in sunshine.

I. Prevent Entrance of Dust.

Illustrate action of invisible life by showing mouldy bread or mouldy cheese.

(*a*) To one tablespoon flour and one teaspoon sugar add three tablespoons boiling water and cover the dish with a tightly fitting cover or one that projects over the edges.

(*b*) In another dish left open place the same mixture. Leave both for several hours and examine.

Explain the cause. Apply explanation to production of foul odors.

II. Preventing Growth of Germ Life.

Experiment 1. *Action of Boiling Temperature.*

Prepare a weak cane sugar solution, divide it, placing $1\frac{1}{2}$ teaspoonfuls in each of three test-tubes.

(*a*) Boil solution and seal with cotton while hot.

(*b*) Boil solution and leave exposed to air.

(*c*) Seal solution 3 without first boiling.

Leave the test-tubes (*a*) and (*b*) in dark place.

Expose test-tube (*c*) to the direct sunshine.

Examine for presence of moulds or bacterial life.

Experiment 2. Dampen flour and leave in dark place for several days.

Let pupils draw conclusions as to the factors which aid growth of moulds and bacteria and how these conditions may be avoided.

III. Removing Stains.

(*a*) Grease stains.

1. Solvents, { Kerosene, Gasolene, Benzine, Naphtha, Chloroform.

2. Soaps or emulsions.

Explain nature of fats or oils and how alkalies may break up the combination, forming a new compound called a soap.

Experiment 3. Pour $1\frac{1}{2}$ teaspoonfuls strong sodium hydroxid solution ($NaOH$) into an evaporating dish or a granite ware dish and add 3 c.c. warm tallow, fat, or olive oil. Boil the mixture, stirring till it becomes clear. Add tiny amount of salt (soap is not soluble in salt water). Soap should collect on top of the liquid. Use it in making soap-suds.

Experiment 4. Prepare a greasy water; add solution of sal soda (Na_2CO_3), or use ammonia or potassium carbonate to form an emulsion. [Wood ashes contain either potassium or sodium salts, depending upon the location of the vegetable growth. Inland woods are rich in potassium salts. Hence the use of wood ashes in removing grease stains.]

(*b*) Stains on metals.

(1) Why metals become discolored.

Copper or brass oxidized by union with oxygen of air.

Iron rust (oxid produced by oxygen in presence of moisture).

Silver — sulphid formed by action of sulphur in food or in air from burning gas.

Aluminium tarnished by acids in foods.

(2) Objection to use of acids.

(3) Polishing reagents.

Whiting or silver polish.

EXPERIMENT 5. Sift one pound jewellers' whiting through fine-meshed cloth to remove the coarse particles. Make the powder into a paste, using soap solution or ammonia in water. Use this on silver, nickel, aluminium, and zinc.

Rottenstone and sweet oil to be used on copper or brass.

Benzine and powdered emery to be used on cut steel.

IV. CARE OF SINK.

Materials used in body of sink.

Plumbing — Form of trap and its value.

Use of strainer.

Disinfection of trap.

Flushing with boiling water,
or soapy water at boiling temperature,
or hot sal soda solution,
or a disinfectant.

Practice work for pupils.

Clean all woodwork, windows, metal, and dishes in the kitchen.

Disinfect the sink drain and dish-cloth.

TO TEACHER. — Prepare Experiments 2, 3, and 4 in class, but have duplicates prepared several days before, so that results may be shown and conclusions drawn.

Encourage pupils to examine and report orally and with

drawings on kinds of traps found in their own homes.

Tell them of the work of Pasteur.

Have the results of work embodied in written exercise on cleanliness.

CHAPTER III

STARCHY FOODS, AND HOW TO COOK THEM

Starch. — All plants contain more or less of a class of compounds called carbohydrates. These contain carbon, hydrogen, and oxygen. The parts of carbon are usually six, or a multiple of six, and the hydrogen and oxygen are in the ratio to form water; that is two parts of hydrogen to one of oxygen. A few carbohydrates are of animal origin, but the larger number form the bulk of the solids of plants.

One member of the group cellulose has been mentioned in discussing woods as fuel. As it forms the main part of the cell wall of all higher plants, and as a rule of the lower plants, which include fungi and bacteria, it is a factor to be considered in all study of vegetable foods. It is insoluble in water though softened by long application of boiling temperature.

The digestive juices of man have little or no action on cellulose. In presence of water and under the influence of bacteria it decomposes, giving rise to marsh gas. This bacterial decomposition may take place in the intestine. It is said to increase the peristaltic action of the intestine and by hastening the elimination of food cause a loss of nitrogen. This was shown by experimental feeding with whole-wheat bread. The results were that less of the nitrogenous products were absorbed on this diet than were during use of white bread.

Starch. — Contained within the cellulose walls of plants are tiny granules of a highly complex carbohydrate, starch. The

characteristic appearance of starch granules may be shown by placing a very thin slice of potato under a low-power microscope. These granules vary in size even from the same plant, but they may be recognized by peculiar markings upon the surface as well as by shape. The starch seems to be deposited in layers around one or more nuclei, — hence concentric rings may be observed. When subjected to water and low heat, these layers absorb the water, and thus the markings disappear. If the boiling temperature be used, the starch granule loses its regular form, becoming a paste which is slightly sweet and very gummy. Cold water does not form a solution with starch.

When starch is heated with dilute acids, it forms a clear solution. Water seems to have united with it. The last product of this reaction is grape sugar. A ferment in the saliva changes starch into a sugar. A similar change takes place in the starch of seeds on germination. This may be shown by chewing in succession barley and the germinated barley known as malt. The first will be tasteless, whereas the germinated barley is sweet with sugar.

Dextrin. — Dry starch may be heated and thus changed into a product which is yellowish in color and soluble in water; this is called dextrin. It is the basis of British gum and of library paste. Long-continued heat causes the dextrin to become brown and bitter. This product is called caramel.

Beyond this stage the product is soon transformed into carbon. Water is driven out, thus leaving carbon free.

Iodine Reaction. — Starch paste gives a blue color with iodine solution, so that its presence even in minute quantities may be detected. This is used in connection with the microscope to detect adulteration of spices with foreign starches. The test may be easily applied to so-

called baby foods, where starch should not be present, as the very young baby cannot digest starchy foods.

The simplest way to determine the amount of starch in a food is to reduce it to powder in a mortar, and mix with water to form a medium dough. Tie the dough in a loosely woven cloth, so that no part except starch may escape. Place the bag of dough in a bowl of cool water and knead with the fingers till no more starch can be washed from it. This is shown when the water runs clear, not milky, from the bag. Let the starchy water stand till all starch has settled, drain or siphon off the water. Dry the starch in the sun and weigh. If the weight of food is known, the ratio will show roughly the amount of starch in the food. The residue in the bag will be cellulose and insoluble proteins. If it be flour which is examined, the product is largely gluten, and may be examined at this time.

Digestion of Starch. — During the mastication of food any starches are mingled with the saliva, which, if its reaction is alkaline, begins the transformation of starch into a sugar. The partially transformed starch on reaching the stomach meets an acid secretion which in the course of half an hour usually neutralizes the alkaline saliva. The stomach ferments have no action upon starch, hence it passes without further change into the small intestine. Here the change into soluble sugars is completed by other ferments secreted by the pancreas and by the intestine.

Use of Starch. — Starch, when digested, is utilized in the body in furnishing energy expended as body heat, as work, or stored as fat. It never builds any other tissue in the body, hence must always be used with muscle-producing foods, the proteins.

Method. — Starch.

Composition and Form. — Use a microscope to show individual granules as well as position in cell. (Cut a

very thin slice of raw potato to illustrate cells containing starch.)

Experiment 1. *Composition.* — Place dry starch in test-tube and apply heat from Bunsen burner. Note the change in color, the odor, the moisture on sides of tube, and near end of experiment apply lighted match to mouth of test-tube to ignite the combustible gases driven off. Break tube and examine its contents.

If nitrogen were present, the odor would have been like burnt feathers.

Experiment 2. *Action of Cold Water on Starch.* — To $\frac{1}{4}$ teaspoon corn starch add $2\frac{1}{2}$ teaspoonfuls cold water. Mix thoroughly. Allow it to stand till starch settles. When water is clear, drain it off and dry the starch. Draw conclusions.

Experiment 3. *Action of Boiling Water on Starch.* — To $2\frac{1}{2}$ teaspoonfuls boiling water in test-tube add $\frac{1}{4}$ teaspoon dry starch, without stirring. Examine the lumps and explain the condition.

Experiment 4. *Action of Heat on Cold Water Mixture.* — To $\frac{1}{4}$ teaspoon corn starch add $2\frac{1}{2}$ teasponfuls cold water. Mix thoroughly, and continue to stir while heat is applied. Use a thermometer to note the temperature when mixture becomes thick, when clear. What has become of starch granules. Dilute with water. Draw conclusions.

Experiment 5. *Action of Cold Water on Vegetables soaked in them.* — Wash and pare a potato, slice it, and let slices soak in cold water for one-half hour. Examine the water. Drain and apply heat to the white sediment in dish. It thickens. Why ?

Experiment 6. Put rice in boiling water. Note the milky color of fluid. Let this product stand and examine sediment. Apply heat as in Experiment 5. Are the results similar ? (Dry the rice for future work.)

Should starchy vegetables be soaked in cold water ?

Boiling Vegetables.

Experiment 7. Wash and pare thinly two crisp potatoes. Place them in boiling salted water. (1 tablespoon salt to 1 quart water.) Continue to boil the water till the potatoes are soft. Remove one from the water and keep in warm place, uncovered. Cook the second potato longer or till gummy. Compare the dry, mealy condition of the first with the gummy, slightly sweet condition of the second.

Give list of Starchy Foods.

Experiment 8. *Home Work for Pupil.*—Pare a large potato, and grate it into a bowl of cold water. Drain off milky water and add fresh. Save the milky water. Repeat this process till starch is all washed from the fibre.

Let the water stand. Drain and dry the starch. Dry the fibre or cellulose left after washing out the starch. Bring the results to the class.

If the period for work will not permit every experiment, omit those on rice. If a microscope is not available, place drawings on board, and have pupils hold thin slices of potato to the light to see structure.

The boiled potato may be put through vegetable press, thus making riced potatoes. The potatoes used in Experiment 5 may be used in preparing escalloped potatoes.

Caution!—Avoid the use of terms like "starch cell," or "bursting of wall of starch grain," or "starch is made soluble," or "dissolves," because they do not express the truth, though commonly used.

Recipes for Pupils

Riced Potatoes.—Select medium sized potatoes, pare, and cut into uniform shape, and cover with cold water till ready for use. Never soak in cold water, as there will be a loss of mineral salts and starch. As soon as possible immerse in

boiling salted water — two quarts water, one tablespoonful salt. Continue to boil the water till potatoes are tender; that is, easily pierced by a fork. Drain and leave uncovered while preparing the dish in which the potato is to be served. When the dish has been dipped in hot water and dried, force the hot potato through a vegetable press, or rub through a colander or coarse sieve, using a wooden spoon, thus piling the product lightly upon the dish. Never touch the product after having passed it through the press.

Escalloped Potatoes. — Scrub, pare, and cut five small potatoes in one-eighth inch slices. Soak one-half hour in hot water to remove some of the acrid flavor. Drain and put into a deep pudding dish in layers, alternating with salt, pepper, butter, and a thin layer of sifted flour. Add warm milk so that it is visible in top layer. Bake in slow oven one and a half hours, or till potatoes are soft. Serve in the dish in which it is cooked.

Transformation of Starch into Soluble Compounds

History of Sauces. — Various liquid or semi-liquid products, which by adding flavor, moisture, or by increasing attractiveness of solid foods render them more palatable, and therefore more digestible, are known as sauces. The early Romans used a sauce which they termed *jus*, but it may have been the meat juice, or gravy, rather than a product resembling our modern sauces. It is surmised that our modern sauce is an evolution of a solution used by the Romans in preserving or maturing meats. Pliny writes of *salsugo* or *salsilago*, a briny pickle in which meat was kept. Thudichum thinks that this standard *jus* became a *salsum* or *salsa*, which the French changed into *saulza*, and finally into *sauce*.

Beginning as meat juice or meat pickle, these additions became more and more complicated, but retained as a basis

the juice or juice diluted with hot water — bouillon, or meat broth. Each nationality has its favorite sauces, but it is to France that we owe the greatest debt, as they held fast to the old traditions, and so improved and increased the number of sauces that long before America was discovered the *sauciers* of Paris had formed a corporation. Before the reign of Louis XI. (1423–1483) they made sauces which the people used to flavor their ragouts. By a patent of Louis XII. this making of sauces was raised in 1514 to the rank of a distinct trade or profession. The era of fine cookery in France began during the reign of Louis XIV., in seventeenth century, when the nobles vied with each other in compounding delicate dishes. From this time on, even into and beyond the French Revolution, the art of cookery flourished to such an extent that writers and artists and statesmen were more proud of being the inventor of a new sauce or a new dish than of their professional skill in other lines — Alexander Dumas is a famous example; while many of our well-known sauces still retain the name of the statesman or noble who created them — for example, sauce à la Béchamel. After the Revolution, the cooks of the nobles, being obliged to provide for themselves, established restaurants where the most delicate and elaborate products of their skill were at the service of the one who could pay the price. The world has adopted the restaurant system, and French cookery is the standard of excellence. The names of these famous cooks are preserved in literature as well as in our recipes. Sauce Robert is said to be named from its inventor, a cook, and to have given the title to a satirical pamphlet by the French historian Thiers. This pamphlet, like the sauce, was not only acid, but very biting, and got its author into difficulty.

The modern sauce is composed of meat essences, vegetable flavors, spices and condiments, held together by a bind-

ing material made by heating flour to a very high temperature so as to change it into a gluelike product. This change is best secured by heating the dry flour and fat together till they become thin, and in some cases brown, when the liquid is slowly added, and all cooked till the product is smooth and velvety. It may then be strained and kept in a cool place till needed, or kept hot in a double boiler till ready for use. Most sauces have as a foundation brown sauce or Roux, or white sauce or velouté, both easily made if materials are perfect and care is used in compounding.

Materials. — Flour, butter, potatoes, turnips, carrots, parsnips, salsify, and asparagus.

Outline. — I. Review of previous lesson.

Cook in boiling salted water the following vegetables: potatoes, turnips, carrots, parsnips, salsify, and asparagus.

II. Action of dry heat on starch.

Experiment 9. Place one tablespoon dry starch or flour on a piece of paper (cellulose) and leave them in a hot oven (300° F.) for fifteen minutes or such a length of time as is necessary to change the color of starch to a light yellow. Note taste and odor. To one-third the product add three teaspoons water and boil. Filter to remove unchanged starch. The solution contains dextrin used as a glue. Add twice its bulk of alcohol, and dextrin is precipitated; filter and dry. Test starch paste with tincture of iodine. Test dextrin with tincture of iodine.

III. Starch or flour cooked in hot butter or other fat, as beef or olive oil.

Experiment 10. To one teaspoon very hot but not browned butter add two teaspoons flour; continue to heat and stir till the flour is thoroughly mixed with the butter, and the mixture has become thin but not brown. (Remove a drop to a white piece of paper and save to test with iodine.) Then slowly add one tablespoon milk or stock, stirring over

the fire till the mixture is thick and smooth, then add a second tablespoon liquid; continue till four and one-half tablespoons liquid have been added. Heat the product to boiling point and season with one-sixteenth teaspoon salt and a few grains white pepper.

The high temperature conveyed by the fat quickly changes the flour into dextrin, which, being soluble, may be diluted with liquid and yet remain smooth and paste-like.

If the flour or the fat be browned in this process, the product contains not only dextrin, but a product of dextrin, dextrin-caramel, which gives the brown color and slightly bitter taste to brown sauces.

IV. What other method of cooking gives the brown exterior to starchy foods?

Explain the use and value of sauces and give something of their history.

Have each pupil prepare white sauce, serving it with one vegetable. Other vegetables if in season may be substituted for any in the list, or the number may be restricted to three.

Roux, or Brown Sauce. — 1 cup hot soup stock, $\frac{1}{4}$ teaspoon salt, $\frac{1}{4}$ saltspoon pepper, 1 teaspoon lemon juice, 1 teaspoon chopped onion, 1 tablespoon butter, 1 tablespoon flour.

The stock may be made from bones from roasts or steak with addition of fresh meat from shin. Cut and break all and cover with cold water. Keep at simmering point three hours. Strain and season with salt and keep in ice chest in closed dish.

Melt the butter and add the onion. Fry till a light brown, add the flour, and cook till the mixture slightly thins, then add the hot stock two tablespoons at a time, stirring each time till smooth, season with lemon, pepper and salt, and strain. This is foundation for many sauces.

WHITE SAUCE ($\frac{1}{6}$ RECIPE)

To one teaspoon very hot but not browned butter add two level teaspoons cornstarch, or two and one-half level teaspoons flour; stir over the heat till the products are thoroughly mixed and have become slightly thinner. Then slowly add one tablespoon warm milk, stirring it over the fire till mixture is thick and smooth, then add a second tablespoon milk, continue till four and one-half tablespoons milk have been added. Heat product to the boiling point and remove from the fire. Season with one-sixteenth teaspoonful salt and a few grains of pepper.

MACARONI

Facts. — Macaroni, as we know it, seems to be original to southern Italy though a similar paste is used in Persia, India, and China, not tubular, however.

The name "macaroni" seems to have come from a Greek word meaning happiness, and hence some authorities imply that it is an invention of the early Greek settlers in Sicily and Calabria. Macaroni may have been introduced into France at the time of the wedding of Catherine de' Medici with Henry II. in sixteenth century.

Macaroni is made of a flour prepared from a wheat grain rich in gluten. This wheat flour is made into a dough with boiling water. The dough is worked under heavy revolving stones till of the right consistency. Upon this process depends much of the quality of the product. This dough is then forced by a powerful plugger through a perforated steel or iron cylinder. As this cylinder is suspended over a fire, the dough is partially baked as it is forced into shape. It is afterwards hung over rods or laid on cloth-covered frames to dry. In Italy, especially in Naples, during this drying it is exposed to dust and odors of every kind.

If the cylinders are large, the product is macaroni; if finer, it is spaghetti; if very fine, vermicelli. When the paste is cut into fancy shapes, it is called *pasta d'Italia.*

French macaroni is made from a flour enriched with gluten and is considered as good or even better than Italian macaroni, but that made in the United States is poor in gluten, starchy, and breaks easily when cooking, presenting an unattractive appearance.

Good macaroni is rough, elastic, and hard. In color it is yellowish gray, never starchy.

When cooked in boiling salted water, it increases at least twice in bulk and does not split.

Food Value. — Macaroni is comparatively rich in nitrogenous food and rich in heat-producers, hence is a valuable and nutritious food. It should be served as a vegetable or with cheese as the principal muscle-producing food at the meal, not as an accompaniment to a meat dish.

Alone, macaroni does not contain the amount of muscle food necessary for the laboring-man, hence its use with eggs, meat, or cheese is essential.

Method. — *Material.* Samples of the various forms in which macaroni or Italian paste is found in our markets, cheese, tomato (can), butter, and flour. Pictures showing native manufacture.

Outline: — (1) History. (3) Manufacture.
(2) Composition. (4) Food Value.

Experiment 11. *Composition of Flour.* — Mix two tablespoons flour with two teaspoons water to form a stiff dough. Knead till smooth. Securely tie in a square of coarse muslin and knead in a bowl containing one quart lukewarm water, till the white material ceases to pass out. Save the water. When white material has settled, drain off the clear water, save the residue, and test for starch.

Examine the product. Note its color and elasticity. It is a compound in flour which by swelling retains the gases in bread-making, or causes the increase in bulk in macaroni during cooking. Form part of it into a smooth ball and cook it in boiling water.

Cooking Macaroni. — Cook in boiling salted water twenty minutes. Drain and pour over cold water to remove any starch paste on the outer part, which if left would cause the pieces of macaroni to adhere to each other.

Review of previous lesson. Prepare white sauce. Prepare tomato sauce.

Serve macaroni with (*a*) white sauce, as

(*b*) Baked macaroni with cheese.

(*c*) With tomato sauce.

While the macaroni is cooking, each pupil may prepare a white or a tomato sauce as review and serve with the cooked macaroni as directed. Essay on macaroni may constitute the home work.

Recipe for Pupils

Tomato Sauce. — 1 cup hot stewed and strained tomato, ¼ teaspoon salt, ¼ saltspoon paprika or white pepper, 1 teaspoon chopped onion, 1 tablespoon butter, 1 tablespoon flour.

Prepare the same as for Roux or brown sauce.

Serve with macaroni.

For white sauce, see p. 73.

Additional Work in Sauces

(*a*) Roux or brown butter sauce is the basis of brown sauce piquante, sauce Robert, and brown mushroom sauce.

(*b*) "White Roux" — a misnomer; white sauce, see p. 39.

Drawn butter sauce, foundation of —

Caper,	Shrimp,	Sauce Piquante,
Egg,	Oyster,	Béchamel,
Lemon,	Parsley,	Curry sauce.

Practice. — Steamed rice with curry sauce; cauliflower with white sauce; cabbage au gratin, white sauce, and grated cheese.

Facts to be noted: —

(1) Sauces must be smooth and free from oil.

(2) Cabbage and cauliflower are cooked when cellulose is tender, usually in twenty minutes. They become tough and strong flavored if cooked longer.

(3) If dried bread be tied loosely in cheese cloth and placed on top of vegetables, as cauliflower, cabbage, or onion, it will in a measure absorb the odors which otherwise escape into the room.

Recipe for Pupils

Cabbage au Gratin. — Select a small heavy cabbage. Remove the outside discolored leaves and cut the remainder into quarters. Soak it in salted water half an hour. Drain, place in boiling salted water, and cook rapidly twenty minutes. Placing stale bread loosely tied in cheese cloth on top of cabbage under a cover will in a measure absorb the odor, so that it will not be objectionable in the room.

At the end of twenty minutes the cabbage should be tender, but still greenish yellow, never brownish yellow. While the cabbage is cooking, prepare a white sauce and grate two ounces of cheese. Drain the water from the cooked cabbage, place quickly in covered vegetable dish, pour over it the hot white sauce, sprinkle over the grated cheese, replace the cover, and serve. The heat from the cabbage and the sauce partially melts the cheese.

Rice

Facts. — Rice as it is found in nature is a kernel covered with two husks, a coarse outer one, which is easily removed,

and an inner reddish one, sometimes seen on rice in market. Paddy is the name given to grain in its husks. In writings the expression "paddy" fields is used to mean rice fields.

The outer husk is removed during the threshing, but the close inner husk must be removed by careful milling. During this process the rice is ground between stones, then pounded in mortars, and finally winnowed by fanning and screening till all the inner husk is removed.

The rice is then sifted into grades, whole, middlings, and small whole grains.

The middlings contain the broken fragments. This is sometimes ground into rice flour.

Food Value. — Rice is deficient in protein or muscle food, fat, and mineral matter, being essentially a heat-producing food. It should be eaten with meat, cheese, peas, lentils or beans, as well as with butter or bacon. It cannot take the place of potatoes unless much fresh fruit is used, as it is so poor in mineral salts that its exclusive use tends to favor scurvy.

Method. — *Material.* Rice, cheese, fruit, milk, pictures of rice fields, slides showing form of granules, and showing its use in adulteration of spices and condiments.

Outline.

HISTORY	Food of one-third of the population of the world; mentioned several hundred years B.C. Used by Greeks and Romans.
BOTANY	Name, — Oryza sativa; Family, — The Grasses; Climate, — Tropical; Part used as food, — Grain; Preparation for market, — Milling; Composition.

Compare with other grains. See table in chapter on Foods, p. 118.

Uses. — Vegetable, cakes, puddings.

Practice. — Necessity of washing rice before cooking. Boiled rice and cheese, steamed rice, — using water or milk, value of.

Browned Rice. — Brown rice in oven as you would coffee berry. When golden brown, steam. Effect is similar to what preceding experiment?

The steamed rice may be served as a vegetable or with fruit and cream as pudding.

Emphasize the necessity of having each rice grain whole and dry; and that rice contains very little muscle food, and therefore must be served with protein foods.

Essay on rice as a food may be the home work.

If possible have rice growing in a pot for pupils to see.

BOILED RICE WITH CHEESE ($\frac{1}{9}$ RECIPE)

Wash one tablespoonful rice by rubbing under water, so as to remove all dirt, and any rice starch from broken grains. Drain and place it in two cups boiling water containing one-half teaspoonful salt. Boil the water vigorously till the rice is tender, fifteen or twenty minutes. Lift the rice from the bottom of the dish, using a fork; never stir it while cooking, as the grains must be individual. When rice is tender, drain and wash with hot water, pouring it over the rice in the sieve. Return rice to the dish and leave it uncovered in doorway of oven or on the back of the stove, till partly dry. Lift in with a fork one level tablespoonful grated cheese. Pile lightly in a dish and serve as a vegetable or substitute for meat dish.

STEAMED RICE ($\frac{1}{9}$ RECIPE)

Wash one tablespoonful rice. Pour over it three tablespoonfuls hot water and cook in double boiler till tender, — about forty-five minutes. (A cup placed in small stew pan

may be used in place of double boiler.) Remove cover from the rice and let excess of water evaporate.

This method retains all nitrogenous products and all mineral salts, hence it is the better way.

RICE PUDDING ($\frac{1}{9}$ RECIPE)

Soak one tablespoon rice one-half hour in eight tablespoons milk; add one teaspoon sugar. Cook in improvised double boiler three hours. Transfer to tiny pudding dish and brown in oven. Serve hot or cold.

CURRY OF RICE ($\frac{1}{9}$ RECIPE)

Wash one tablespoon rice; pour over it three tablespoons stock or milk seasoned with $\frac{1}{8}$ teaspoon sifted curry powder, and boil in double boiler forty-five minutes.

Starch as Thickening Agent

Method. — *Materials.* Corn starch, potato, baker's chocolate, sugar, milk, eggs.

Outline. — Review the work given on pp. 38–39.

Starch. — Cold water has no effect. Hot water hardens in lumps.

(1) Hot water on cold water mixture makes smooth paste.

(2) Boiling water on sugar and flour mixture makes a smooth product.

(3) Flour and very hot fat form a soluble product, dextrin, which is soluble in liquids, forming a smooth gelatin-like product.

Use of Methods in Cookery

Method No. 1. — Thickening soups, gravies, sauces.

Method No. 2. — Puddings, cream pies, pudding sauces.

Method No. 3. — Meat sauces, vegetable sauces, soup thickening.

Practice. — Potato soup, chocolate cream pudding, vanilla sauce, corn starch pudding, chocolate sauce, tapioca pudding.

Emphasize the necessity of thorough cooking to prevent the "raw starch" taste. The recipes used may be any, so that they illustrate the principles.

Essay to be on starchy foods.

Recipes for Pupils

POTATO SOUP ($\frac{1}{3}$ RECIPE)

1 small potato; $\frac{2}{3}$ cup milk; $\frac{1}{4}$ inch cube onion; $\frac{2}{3}$ teaspoon salt; $\frac{1}{9}$ teaspoon celery salt; $\frac{1}{8}$ teaspoon white pepper; 1 teaspoon butter; $\frac{1}{2}$ teaspoon flour.

Prepare the potato as in recipe for riced potato. Heat the onion with the milk in double boiler. Add flour to the melted butter, and when flour and butter are thoroughly united, slowly add the milk, one tablespoonful at a time, till four have been added. Then add the seasoning and the remainder of the milk. Return the product to the double boiler, and add the mashed or riced potato. Heat thoroughly and serve in hot dish.

CHOCOLATE CREAM PUDDING

1 cup milk; 4 tablespoons sugar; 2 tablespoons corn starch; 1 ounce chocolate; $\frac{1}{2}$ teaspoon vanilla; 1 egg — white.

Melt the chocolate in the double boiler, slowly add the milk, and heat to 70° C. (Wrinkles appear on surface of milk.) Mix the corn starch thoroughly with the sugar; add to it the hot milk. Return both to the double boiler and cook till smooth and thick, stirring it all the time. Remove from fire. Beat the white of the egg till stiff, but

not flaky, and fold it into the partly cooled pudding. Flavor it with vanilla and place it in wet pudding mould. Stand on ice for three hours. Serve with vanilla sauce.

VANILLA SAUCE

½ cup boiling water; 4 tablespoons sugar; 2 level teaspoons corn starch; 1 teaspoon butter; 1 yolk egg; ½ teaspoon vanilla.

Mix sugar and corn starch; add the boiling water slowly; boil five minutes; add the butter. Beat the yolk of egg till thick. Slowly add to it the cooked mixture. If heat has not cooked the yolk return the product to double boiler and stir and cook till the mixture is smooth and velvety. Immediately pour into sauce dish, and add flavoring when cool. Serve with or around the pudding.

Tapioca, Arrowroot, Sago

Method. — *Material.* Tapioca, sago, arrowroot, milk, eggs, fruit juice. Examine microscopic slides showing the starch granules.

Outline.

(1) Source of each: —

A. Tapioca.

Cassava plant.
Native of South America.
Family — Spurge.
Part used — root.

Preparation: —

Roots grated, starch washed free from cellulose and the poisonous acrid juice.

B. Arrowroot: —

(1) Name came from poison found in root of another member of the same family, the poison being used by Indians to tip their arrows.

(2) Native of West Indies. True arrowroot comes from members of banana family.
(3) Part used is root stock.
(4) Florida arrowroot comes from root of a plant belonging to pine family. Arrowroot in China is from a water-lily.

C. Sago: —
From Sago Palm.
Part used is the starch from the centre of trunk.

Composition and food value;
Test with tincture of Iodine.

Cookery: —
Used as thickening agent in puddings and jellies.

Practice: —
Tapioca Cream.
Tapioca Jelly.
Sago Pudding.
Delicate Pudding.
(Using arrowroot starch.)

Recipes for Pupils

TAPIOCA CREAM

$\frac{1}{4}$ cup tapioca.
$\frac{1}{2}$ cup water.
1 cup milk.
2 tablespoons sugar.
Yolks 2 eggs.

Soak the washed tapioca over night in $\frac{1}{2}$ cup water. In the morning add it to the milk in double boiler, and cook till tapioca is clear.

Beat the sugar and yolks together till creamy, and slowly add the cooked tapioca and milk. Return then to double boiler, and cook and stir till product is creamy. It usually requires five minutes. Cool, and flavor with $\frac{1}{2}$ teaspoon lemon or vanilla.

SAGO PUDDING

$\frac{1}{4}$ cup sago.
1 cup milk.
1 egg.
2 tablespoons sugar.
$\frac{1}{16}$ teaspoon salt.
$\frac{1}{4}$ teaspoon vanilla.

Wash the sago, and soak two hours in milk. Beat the egg and sugar together, add the milk and sago, the salt, and the vanilla. Place in pudding dish, and bake in slow oven one hour. Serve hot or cold.

Corn

Facts. — Corn, as it is called in United States, is an American plant belonging to the grass family. It is known as *maize* in England, as *mais* in Germany, and *granturco* in Italy.

When ground, corn is known as Indian meal. In Italy this, made into a porridge or mush, forms a staple article of diet under the name of "polenta," in Ireland, "stirabout," and in British Honduras it is called "corn lob."

In the United States this fine meal is used with wheat flour in making unleavened bread. In Mexico a preparation called *tortillas* is made from corn, which has been first soaked in lime water and then ground between a stone slab and a roller, formed into thin, flat cakes, and cooked on thin iron plates or heated stones.

In our markets corn is found as meal, which is the entire kernel ground fine; or, it is first soaked in lye solution to soften the outer coating, then rubbed and washed to remove it. The hulled corn is known, according to the size of the parts broken or split, as coarse hominy, fine hominy, grits, and samp.

The hulled corn, steamed and rolled, is sold as corn

flakes, or cerealine. Washed free from its cellulose, the residue is known as corn starch.

Food Value.

Because of the very small percentage of gluten, corn products, as meal, may not be used alone to form light bread; but, mixed with flour, it forms a food somewhat less nutritious than wheat bread.

Corn is quite rich in fats, but poor in protein, and stands, therefore, between rice and wheat in nutritive value. Alone, it cannot be used as a food, but eaten with milk or other product which supplies the lack in muscle food, it is a very fair food, though always rich in heat producers.

It must always, no matter what the form, be thoroughly cooked if it is to be of most value. In preparing mush the product should be cooked at least two hours in a double boiler.

Method. — *Material.* Corn on the ear with its husk showing; pictures of corn fields and corn in shock. Samples of corn; preparations in market. Iodine as test.

Outline.

(1) History — Native of United States. Introduction into England in 1846. Use in Italy. Use in Mexico.

(2) Literature — "Hiawatha."
"Mondamin," Bayard Taylor.
"Corn Song," Whittier.

(3) Botany — Name in various countries.
Family — The Grasses.
Varieties.
White.
Yellow.
Red.
Sweet.
Pop.
Cultivation.

(4) Preparations in the Market:—

Samp.

Hominy — coarse, fine.

Meal.

Corn flour or starch.

Cerealine flakes.

Sweet corn.

Pop corn.

(5) Food Value.

(6) Uses: —

Breakfast food or grain.

Bread.

Vegetable.

Grape sugar.

Whiskey.

Fodder for animals.

Fuel in the West.

(7) Cookery: —

Essentials.

Soften cellulose, hydrate starch. Time depending on form.

(8) Practice: —

(*a*) Review of use of starch as thickening agent.

Green corn soup.

Corn chowder.

(*b*) Cooking of vegetables in boiling water: —

Green corn on cob, boiled or steamed.

Boiled hominy (5 hours).

(*c*) Use as bread in different parts of the country: —

Corn muffins.

Corn cake.

Hoe cake.

Rhode Island johnny cake.

Corn dodger.

Indian bannock.

Have corn growing so that pupils are familiar with its appearance. Steam the green corn with its husks on if it be in season, otherwise use canned corn in other recipes.

GREEN CORN ON COB

Remove the husks and all "silk." Place at once in kettle of boiling water and boil the water ten minutes.

Remove from water, heap on a platter and serve at once; or

Remove only the outer husks, leaving the inner delicate greener ones. Place in boiling water, and boil water fifteen minutes. When done, remove silky threads and serve in husks.

GREEN CORN SOUP

$\frac{1}{2}$ cup raw pulp from 3 ears ripe green corn; 1 cup milk; $\frac{1}{2}$ teaspoon sugar; $\frac{1}{2}$ teaspoon salt; $\frac{1}{16}$ teaspoon white pepper; 1 teaspoon butter; $\frac{1}{2}$ teaspoon flour.

With a sharp knife score or cut through the middle of each row of kernels and then remove pulp by scraping. This secures the pulp free from tough wall of the grain.

Break the cob in short pieces and cover with cold water. Raise water to the boiling point and boil twenty minutes. Strain, and if there is not a cup of water add boiling water to fill cup. To this water add the pulp of kernels, and cook fifteen minutes; then add the salt, pepper, sugar, and milk, and again warm in double boiler. Melt the butter, add the flour, and stir and cook thoroughly to change it to a gummy substance. Slowly add the milk and corn mixture and boil five minutes, or till smooth and creamy.

Canned corn may be used in place of green corn. In this case cook the corn twenty minutes in boiling water and then press through a sieve to remove tough cell walls.

BOILED HOMINY

1 part coarse hominy, 5 parts cold water.

Soak the hominy in the water over night. Drain off the water and heat it to the boiling temperature; slowly add the soaked hominy, carefully stirring. Raise all to the boiling point, place it in double boiler and cook four hours. If not soaked, five hours' cooking in double boiler is necessary.

Serve as a breakfast grain or use seasoned with salt in form of vegetables.

Fine hominy requires four parts of water and four hours' cooking in double boiler.

POTATOES

Facts. — *Food Value.* The potato contains about seventy-five per cent of water, or from fifteen to twenty per cent more than meats.

The remaining one-fourth is mainly starch, the protein being but little over two per cent.

Weight for weight the potato contains one-fourth as much starch as rice and one-fourth as much protein, but contains twice as much mineral matter.

Man is able to digest nearly all the starch found in the potato, but only two-thirds of the protein, so that the potato is essentially a carbonaceous or starchy food, valuable only for heat production. Because of the mineral matter in potatoes they are classed among the valuable vegetable foods.

Soaking peeled potatoes in cold water not only removes part of the starch, but wastes a very large portion of the small amount of protein in the potato, hence cooking the potato in boiling water with the skin on is the least wasteful method.

White Potato

Materials. — Potatoes, eggs, meat, fat for deep frying, fat for sautéing, onion.

Outline.

(1) History: —

Native of Chili, Peru, and Mexico.

Introduced into Europe 1565.

Became popular at end of eighteenth century.

(2) Botany: —

Name — Solanum tuberosum.

Family — Nightshade. (Egg plant and tomato belongs to same family.)

Climate — Tropical and Temperate.

Propagation — by buds or eyes in tubers.

Part of plant used.

(3) Composition: —

[Note: — Peel or rind contains a poison dissipated by boiling temperature.]

(4) Food value.

(5) Uses: —

Vegetable.

Laundry starch.

Dextrin or British Gum.

Grape sugar.

Brandy.

(6) Cookery: —

(*a*) Boiled,
Product used for Potato Balls.

(*b*) Steamed,
Product used for Lyonnaise potatoes.

(*c*) Baked,
Used for stuffed potatoes.

(*d*) Fried,
Saratoga or French.
(*e*) Sauté,
French potatoes.

Points to note are that starch granules should be dry and mealy, cellulose softened, otherwise the product is not attractive.

The sweet potato may be used in this lesson, but pupils should know that botanically they are not closely related.

In frying the cellulose is toughened, leaving product stiff or hard.

Recipes for Pupils

POTATO BALLS

Boil one medium-sized potato. When tender, mash thoroughly and add for every half cup potato $\frac{1}{8}$ teaspoon salt, $\frac{1}{16}$ teaspoon white pepper, 2 teaspoons beaten egg.

Mix thoroughly and with floured hands shape into balls one and a half inches in diameter. Place them on an oiled granite pie plate, brush them with the beaten egg, and brown in a hot oven. Serve on platter around a meat product, as roast or braised meat, or serve in separate dish.

LYONNAISE POTATOES

Wash and remove eyes from one old potato. Place in steamer over boiling water and steam till tender. Replenish with boiling water, as, if steaming stops, the potato will be watery.

When just tender place the potato in the oven to dry for a few moments. Remove skin by drawing it off without cutting the potato. Cool. When cold cut the potato into dice and season with salt and pepper.

Cook 1 teaspoon onion in 1 tablespoon butter till onion is brown. Add the potato and continue to cook, shaking the dish to hasten the absorption of the butter by the potato. Add $\frac{1}{2}$ teaspoon chopped parsley, and serve hot, piled on a warm platter.

SAUTÉD POTATOES

These are prepared as in recipe for Lyonnaise potatoes, except that the onion is omitted.

STUFFED POTATOES

Select smooth, even-sized potatoes, scrub, and place in hot oven till when fork is inserted steam escapes. This takes about 45 minutes. While hot, cut slices from top of each, and scoop out the inside. Mash it quickly and season with 1 teaspoon butter, $\frac{1}{16}$ teaspoon salt, and 1 tablespoon finely chopped ham to every half cup mashed potato. Fill the skins with this mixture, rounding it slightly above the edge. Set in the oven to brown the tops — about 5 minutes.

SARATOGA POTATOES

Wash and pare a potato of even diameter. Slice (with vegetable chipper) into ice water. Let them soak two hours. Drain, and dry quickly between cloths. Immerse a few at a time in smoking hot fat (185° C.). Keep them turning till a golden brown. Drain, and place the slices on unglazed paper. Salt, and serve hot. They may be made several days before using and then warmed in the oven.

Transformation of Starch into More Soluble Compounds

Method. — *Materials.* Crackers, bread, corn starch, acid, HCl or H_2SO_4, Fehling's tablets, malt extract, grape sugar. Test-tubes.

Outline.

(1) By Heat: Review of work on dextrin, chew crust of bread and note sweet flavor.

(2) During Fermentation: To thin, warm, but not hot, flour paste add yeast solution.

Experiment 12. (*a*) 1 teaspoon flour; 2 tablespoons boiling water; $\frac{1}{4}$ yeast cake dissolved in 1 teaspoon cool water. Leave for 3 hours in warm place.

(*b*) To 1 teaspoonful of the solution add a Fehling's test tablet, to be procured at any drug store. Apply heat gently.

Repeat this experiment, using unfermented starch paste.

The starch solution should remain blue in color, while the fermented product should turn yellow or red, showing presence of a sugar.

Should starchy foods be cooked?

Experiment 13. Prepare a starch paste as in Experiment 4 and add to cool product amylolytic extract of pancreas (purchased in druggist's shop). Leave for half or one hour. Test with Fehling's reaction.

Experiment 14. Let each pupil chew for a long time a piece of cracker and tell what taste is developed.

Résumé of digestion of starch and its use in human economy.

When may infants be fed starchy foods and be able to digest them?

Malt Extract.

Experiment 15. To starch paste add malt extract and leave for one hour. Test with Fehling's tablet.

May malt extract be used with starchy foods?

The experiments in this lesson may be performed before the class, but if possible let the pupils do the work so that they may gain a clearer insight into the subject.

Let each pupil see that her saliva is alkaline, using a tiny

piece of red litmus paper. Between meals the reaction may be very faint.

Let each pupil write an essay on digestion of starch.

Starchy Foods for the Sick

Materials. — Rice, milk, cream, eggs, sugar, malt extract, bread, Fehling's tablet, baby foods as found in the market, iodine.

Outline.

(1) Review of digestion of starch. See p. 66.

(2) Starch partially changed into soluble form by long cooking.

(3) Starch changed into dextrin by high heat.

(4) Starch changed into maltose by action of malt extract.

Practice.

Cream of Rice Soup. — (*a*) Boil rice in white stock till very tender.

(*b*) Put through sieve.

(*c*) Add cream and season with salt and pepper.

Proportion: $\frac{1}{4}$ cup rice, 1 pint soup stock, 1 tablespoon cream, salt and pepper.

Rice Cream. — Cook rice with milk in double boiler for three hours. Rub through sieve, add sugar and salt. Heat and pour on to beaten eggs. Return to double boiler and cook till creamy, — five minutes. Flavor with lemon.

2 tablespoons rice, 2 cups milk, 2 tablespoons sugar, 1 salt spoon salt, 2 eggs.

(3) Bread made into toast by long heating in oven or till golden brown throughout; dipped in hot milk and served on hot plate with cream sauce.

(4) **Rice Gruel.** —2 tablespoons cooked rice, 1 pint milk. Cook together in double boiler half hour, put through sieve, season with salt and pepper and add one tablespoon malt extract. Leave for one hour and serve either cold or hot.

Impress the necessity of thorough cooking of starchy foods when they are to be used in diet for the sick.

Insist on toast being made correctly and served daintily and hot.

Let part of the rice gruel be tested with Fehling's reaction to show presence of maltose.

Give talk on baby foods and dangers from their use. Test them with iodine.

ADVANCED COURSE — STARCHY FOODS, AND HOW TO COOK THEM

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NOVEMBER

FOODS

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CHAPTER IV

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GENERAL BIBLIOGRAPHY

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The following invaluable pamphlets may be had free on application to the Department of Agriculture, Washington, D.C.: Farmers' Bulletins: No. 23, Food, Nutritive Value and Cost; No. 29, Souring of Milk, and Other Changes in Milk Products; No. 34, Meats, Composition and Cooking; No. 42, Facts about Milk; No. 57, Butter-Making on the Farm; No. 63, Care of Milk on the Farm; No. 71, Some Essentials of Beef Production; No. 74, Milk as Food; No. 93, Sugar as Food, Mary Hinman Abels.

Bulletin No. 21, U.S. Department of Agriculture, 1895, Investigations on the Chemistry and Economy of Food, Atwater. This may be obtained for fifteen cents from the Superintendent of Documents, Washington, D.C.

The following magazine articles may be of value: Forum, vol. 13, p. 448; vol. 16, p. 110. Century, vol. 11, p. 238; vol. 12, pp. 59, 237, 397, 733; vol. 14, pp. 135, 257; vol. 21, p. 101. Popular Science Monthly, vol. 22, p. 677; vol. 26, p. 468; vol. 29, pp. 63, 250. Chautauquan, vol. 22, p. 577; vol. 23, p. 174. McClure, vol. 3, p. 303.

The files and the current numbers of the American Kitchen Magazine are suggestive and valuable. Especially valuable in this connection

are the following: vol. 4, Water and Air as Food, p. 257; Experiments with Starch, p. 218; vol. 5, Drinking Water for Summer Tourists, p. 141; vol. 6, Diet in Health, p. 156; Providing Food for a Typical American Family, p. 26; Experiments with Milk, p. 263; vol. 4, Experiments with Albumen, Fish, and Meats, pp. 66, 230.

See also the bibliography given in the chapter on Starchy Foods, on Fish, on Bread, and on Cooking of Proteids.

Although none of the books whose titles are given above are either too technical or too expensive eventually to form a part of the working library of the grade teacher, yet for the benefit of those who have not access to large libraries, the writer would suggest beginning with the government publications, later adding to these Mrs. Richards's two little books, Dr. Green's Food Products, Yeo's Food in Health and Disease, Thomspon's Practical Dietetics, and Mathieu Williams's Chemistry of Cookery.

Food.— Atwater defines food as material which, when taken into the body, serves either to form tissue or yield energy, or both. This definition, he says, includes all ordinary food materials, since they both build tissue and yield energy. It includes sugar and starch, because they yield energy and form fatty tissue. It excludes the so-called nitrogenous extractives of meat (the chief part of beef tea), and likewise tea and coffee, because they neither build tissue nor yield energy, although they may at times be useful aids to nutrition.

Milk

Facts. — Milk contains all the elements needed for food, and each in about the right proportion. It is, moreover, easy to digest. For these reasons it has been justly called a perfect food. It is not only the exclusive food during the more or less brief infancy of the mammals, but many adults, even at the present time, live for the most part on it, drinking from four to seven pints per day. This is true of the Swedish and Norwegian peasants, the inhabitants of Swit-

zerland and the Tyrol, the Bedouins of Arabia, and the people dwelling in the mountainous regions of Asia, and on the pasture lands of the Sahara.

It is the main dependence of the modern physician in treatment of fever, and for invalids generally.

In earlier ages, and indeed even now in many countries, it was the milk of asses, goats, camels, that was common. Now it is the milk of the cow that is the best known. This is because no other animal can be so easily and economically kept and propagated in proportion to its milk and meat producing powers.

It is absolutely necessary that the milk should be a good quality, unadulterated with water, and from healthy, well-fed animals. Only an expert chemist is able to pronounce accurately upon the quality of milk; but public attention has been called of late so much to the subject of milk that it is quite possible, even in cities, to secure good milk by paying a fair price for it.

Milk undiluted with water clings to the glass. This is a much safer test than depending upon the color. That may be due to annetto.

It should be kept from the beginning in absolutely clean vessels, and in a cool place.

Cream. — After the milk has stood for some hours the cream rises to the top. This may form a thick layer, one-fifth of the total thickness, or it may be very much thinner, depending for the most part upon the breed of cow.

Butter. — Even a superficial examination shows that cream is very rich in fat. When it is agitated for some time — churned — this fat shakes itself free from its curdy envelope, and is collected together in the form of butter.

Butter still contains some water and a very small per cent of curd. An excess of either of these elements will interfere with its keeping, and cause it to become rancid. For

this reason it is always washed and pressed as free from these as possible.

Butter must be kept in clean, closed dishes. Even a few hours' exposure will injure its flavor. No place needs to be cleaner than a dairy, and no place is cleaner than an up-to-date butter factory.

Oleomargarine, well made, looks like butter, tastes like it, and will keep sweet much longer than the real article. It is, moreover, cheaper. It is made from animal fats by a chemical process, the principle of which was discovered during the Franco-Prussian War, and used by its discoverer to supply the French army with butter.

There is not the slightest objection to buying, selling, and using it, under its proper name; but, of course, no one wishes to pay for it the higher price of butter.

Buttermilk. — "A man may live without bread, but without buttermilk he dies," says a proverb of one of the shepherd tribes of India. The laborers of Ireland, Scotland, some parts of England, and in South Wales, as well as the inhabitants of India, know its food value and drink large quantities of it. It is, of course, very like skim milk in composition. The principal difference is that some of its sugar may have changed to lactic acid. To this it owes its peculiar and usually pleasant, slightly acid flavor.

"Curds and Whey." — If to buttermilk or skim milk a little vinegar is added, the fluid will separate into two parts — a solid, the curd, and a watery fluid, whey.

The same result may be obtained by letting the milk "sour" by long standing. The resultant of the latter process is called bonny clabber. When this is heated and strained, our familiar cottage cheese is made.

These curds consist, for the most part, of the protein of the milk. In the whey are salts and free acids and water. These may be shown by evaporating the whey.

Composition of Milk. — In other words, this crude analysis of milk has shown that it is composed of fat, sugar, curd (protein), water, and salts of various kinds. As a matter of fact, the composition of milk may be roughly stated about as follows: —

Water	.87
Milk sugar	.047
Fat	.04
Curd	.036
Salts	.007

Each of these constituents of milk may be considered as the representative of a large class of foods. To give them their scientific terms, sugar represents the carbohydrates; butter, the fats, or hydrocarbons; curd, the proteids; whey, water and the mineral salts. It is scarcely necessary to learn these terms until later, provided that in your own mind you put the sugars and starches into one pigeon-hole; the fats and oils into another; curd (cheese), meat, white of an egg, into another.

Method.— Discuss milk. Remind the children of their early days. Allow them, within limits, to give their later experiences with cows.

As to its quality, taste, color, etc. Remind them and impress upon them the necessity for absolute cleanliness in caring for it.

Put a half-pint of thick cream in a jar. While each child is taking her turn at shaking it vigorously, the others may examine smaller portions of cream, comparing it with milk.

In about fifteen minutes, with good luck, butter will come.

How does this differ from our butter? What should we do to it?

Fresh butter is delicious. Even jaded American palates

may be made to appreciate it if it is eaten upon saltine crackers and with it is drunk a cupful of the buttermilk.

Tell the children of the healthy European custom of a slight early breakfast of bread, freshly made butter, and perhaps honey. Tell them, too, that Americans are recognized because they will insist upon "gilding the lily," that is to say, salting their butter.

Make bonny clabber, or to milk let each student add a little vinegar. What has happened? What do the curds look like? What do they taste like? How is cheese made?

What does whey taste like? What does it look like?

Of what five things, then, is milk composed?

Drill on the component parts of milk. Ask them to give other foods that contain fats, sugars, protein, water.

Protein

Protein may be considered under three heads, the proteids, proper, the so-called "extractives," and the amids. The extractives give flavor to the meat, and are readily extracted from it with cold water. They are in consequence the chief ingredients of beef tea. The amids, vegetable extractives, are found in asparagus, potato, turnips, beets, and many other foods.

The proteids are also called nitrogenous compounds. This name has as much reason for being as that of proteids, for they are the only class of foods containing nitrogen.

Nevertheless, in spite of the excellent reasons for calling these food materials nitrogenous compounds, the term usually applied and generally preferred is protein for the whole, and proteids for the tissue-forming parts.

The white of eggs, the curd of milk, lean meat (muscle), gluten of wheat, gelatin and glue from bones and gristle, are the commonest proteids.

Of these, gelatin, glue, and gristle are commonly called gelatinoids. They do not help to build up the body, but they are useful fuel foods, and for this reason protect the real "flesh formers" from consumption.

These real flesh formers, or muscle formers as they are sometimes called, are the albuminoids. This is a word properly restricted to the first proteids mentioned, viz., the white of the egg (albumen, hence the name), lean meat, curd of milk, gluten of wheat, etc. The albuminoids serve as fuel, too, but their chief function is the manufacture in the body of muscle, tendon, and cartilage.

Not only are meats, fish, eggs, and milk rich in protein, but so also are many foods of vegetable origin, notably peas, beans, wheat and graham flour, and oatmeal. But the protein of vegetables is much less easily and completely digested than that of animals, and therefore they are not nearly as valuable food stuffs as the more easily digested meats. For "we live not upon what we eat, but upon what we digest."

Summary.*

Protein.
- I. Proteids
  - Albuminoids (flesh formers, sometimes also fuel food).
    - White of egg.
    - Curd of milk.
    - Lean meat.
    - Gluten.
  - Gelatinoids (fuel foods).
    - Gelatin from bones.
    - Gristle.
- II. Extractives (stimulants only).
  - Flavoring juices of meat.
- III. Amids (fuel foods).
  - Found in potatoes and other vegetables, also in the fruits.

* This summary, slightly adapted from Atwater, is given for the benefit of the teacher. She must remember that the gelatinoids, extractives, and amids, after all, make but a small part of the protein of foods; that,

The simplest test for albumen is the fact that it is congested by heat; this is the test for albumen used by physicians in diagnosing diseases of the kidneys.

Add to a test-tube one-third full of the suspected fluid two or three drops of strong nitric acid. Heat gently — a pale yellow color will result. Allow the liquid to cool. Add a few drops of ammonia. A deep yellow color indicates the presence of ammonia; a deep orange color indicates the presence of albumen.

Method. — The relation of the white of an egg to the yolk, its color and its consistency, are too well known and too obvious to be made the subject of much study. Instead, ask the question: Is the white of the egg perfectly soluble in cold water? Let the children experiment. What is the effect of heat upon it? Let them boil water in which the albumen has been dissolved, first filtering it.

Teach them the name of this class of foodstuffs, and their great value in repairing the body. They and their kind are the only flesh builders; other foods are fuel foods. Remind them of the previous experiment with curds, and tell them that the great value of meats and fish lies in the fact that they, too, are rich in proteids.

These are all of animal origin. Do any foods of vegetable origin contain proteids? Why do you think so? (Herbivorous animals must get their flesh builders from the vegetable kingdom.)

Let each child chew a handful of clean wheat, breaking the grains carefully in the mouth, and chewing with the idea of making wheat gum. The action of the saliva removes

therefore, it is approximately correct to speak of the protein or proteids, or nitrogenous foods, as the flesh formers. It is much better to teach this thoroughly than that the children should have in their minds a painfully distorted picture of the truth, in which, owing to the difficulty of teaching them, the amids, extractives, and gelatinoids are very much in the foreground.

from the wheat its starch, sugar, and some of the oils. Practically only the tenacious gluten is left. This is almost pure protein. Iodine may be used to prove the original presence of the starch and its disappearance, resulting from the process of chewing.

The presence of gluten in flour may be demonstrated by letting each child wash thoroughly a small quantity of it loosely tied in a cheese-cloth bag. The starch and sugar is washed away. The gummy mass left behind is almost pure protein.

For the clearer understanding of gelatinoids it might be well first to use two familiar experiments to demonstrate the dual composition of bones.

First, burn a good-sized bone in a hot fire, protecting it from the charring contact with the flame, if possible. All the animal matter will be burned out, leaving behind only a white, porous, limy framework. Children will do this work at home under direction, and love to own and exhibit the resulting specimens.

Second, cover a fair-sized clean bone with dilute hydrochloric acid over night. In the morning the salts of lime will be dissolved. The animal matter which remains is of the nature of gristle. The bone may be twisted and bent, or even tied in a knot, with ease.

This animal matter is a gelatinoid.

To show this let perfectly clear bones simmer for several hours. Let each child examine the water. Remove the bones. Evaporate the greater portion of the water by boiling. Set the rest away to cool. Show the class the jelly-like resulting gelatinoid. It will dissolve again by warming it.

To demonstrate the extractives, let each child examine a small piece of raw lean meat, noting in passing the muscle fibres and connective tissues. Let each put her

piece in cold, slightly salted water, watching the extraction of the juices, and later examining both the meat and the liquid.

The object of these experiments has been merely to familiarize the children with the various forms of protein, to add to his vocabulary the words *proteids* and *extractives,* with possibly the terms *albuminoids* and *gelatinoids,* although these last terms are not nearly so essential as the facts concerning them.

The Carbohydrates

By this term is meant compounds made up of the carbon, and hydrogen and oxygen, in certain definite proportions.

In this class may be included starch, the sugars, cellulose.

For facts concerning them and methods of teaching see the chapter on Starchy Foods.

The Hydrocarbons

Facts. — The hydrocarbons (fats and oils) contain the same chemical elements as the carbohydrates, viz., carbon, hydrogen, oxygen, but the relative proportion of the oxygen is much smaller. For their combustion in the body, therefore, more oxygen must be taken from the air. Consequently from them a greater quantity of heat is evolved. They are obviously the most efficient fuel foods, and are, therefore, relatively more used in the northern climes, and in dead of winter, than in warmer regions and in summer. Luckily instinct taught us this long before science demonstrated it.

Fats are also stored up in the body for times of need. It is thought that they pass through the mouth and stomach absolutely unchanged. Even the bile and pancreatic juice

seem only to emulsify it, and this, after all, is merely a physical change. The finely divided oil is carried by the blood and deposited in the spaces between the muscle bundles, ready to be used when needed.

Fat is found in most food materials. It is found in large quantities in meats (tallow, lard); in milk (butter); in various vegetables, such as cotton seed, olives, etc.

Method. — Show the children fat in connection with meal. What is it? What color is it? Have you ever seen it yellow in color? What did that indicate? (Age.) Heat the fat. What change takes place?

Do we get fats or oils in vegetable food? Why do you think so?

Distribute an oily seed, such as nutmegs, cotton seed, peanuts, or nuts of any kind, squash. If necessary tell the children to remove the outer coat. Prick with a pin. Oil will at once ooze out.

Tell me at what time of the year you are most inclined to eat fats. What people eat fat more eagerly than we do? Why? What then is the use of fat food to us? Are the other foods, too, available as fuels? (Even the proteids may be consumed for fuel.) What advantage, then, to eat fats when food fuel is needed? (To save the proteids for their more important and untransferable work — of building up the tissues.)

Inorganic Food Materials

Salt. — Of these the commonest is common salt, but the lime salts, iron, magnesia, potash, and phosphorous, are also necessary. They are, however, contained in sufficient quantities in various common articles of diet. Lettuce, for example, furnishes plenty of potash. Salt, however, is added from without. So necessary is it to man that when the need for revenue was most urgent in

India, France, and other countries, then recourse was always had to the "salt tax," since even the poorest would buy salt regardless of the increase in price. The salt licks of the prairie or deserts are greatest attractions of these regions to all the animals near.

About half a pound of salt is the normal quantity in an adult's body. Since this constantly wastes away in tears, and in sweat, it is necessary that it should be constantly replenished. Nevertheless, the amount of salt used is often excessive and is the result of a dulled sense of taste and of habit, rather than necessity.

Such expressions as "the salt of life," "Attic salt," "to taste a man's salt," and "he flavors his food with salt" (meaning he is wealthy) show the esteem in which salt has been held from the earliest times. It is a symbol of wisdom and wit and hospitality, and in the African gold coast region, of wealth. There formerly a slave or two could be purchased for a handful of salt. The best table salt is most cheaply made by evaporating water from salt springs. This business is carried on in an extensive scale in New York, Michigan, Ohio, Virginia, and West Virginia.

It is also produced from sea-water and mined as rock salt.

Water

Water, constituting as it does about eighty-seven per cent of the whole bulk of the body, wasting every moment, too, must be of necessity a most important element of food.

Says Edward Smith in "Foods": —

"It is required for many purposes: First, to soften or dissolve solid foods so as to facilitate their mastication and digestion; second, to maintain a due bulk of blood and the structures of the body; third, to keep substances in solution or suspension, whilst moving in the body; fourth, to supply elements in the chemical changes of the body; fifth, to

enable the waste materials to be carried away from the body; sixth, to discharge superfluous heat by transpiration through the skin, and by emissions though other outlets; and seventh, to supply in convenient form heat to, or to abstract heat from, the body. Some of these functions are performed by water in its liquid state, and others in a state of vapor."

Our foods contain more or less water. "In general," says Atwater [Gov. Report "Foods"], "animal foods contain the most water and vegetable foods the most nutrients, though potatoes and turnips are exceptions, the former being three-fourths and the latter nine-tenths water. Butter, on the other hand, though one of the animal foods, generally has only ten or more per cent water. The milk from which it is made is not far from seven-eighths water. Meats have more water in proportion as they have less fats; and *vice versa*, the fatter the meat the less the amount of water in it. The flesh of fish is in general more watery than ordinary meats. Flour and meal have but little water, and sugar when well dried has almost none."

The best and most agreeable water for drinking purposes is moderately soft spring water. Where this cannot be obtained, soft surface water may be used, provided that it is sand filtered before it reaches the consumer. Unless this is known to be very perfectly done, it is safer to boil it ten minutes, setting it away in a refrigerator in clean glass bottles. Water so treated is cool enough to be agreeable to the taste, not cold enough to chill the stomach, and absolutely free from disease bacteria.

The worst water for drinking is that from wells. This water source is so commonly used in the country, and such a prolific cause of disease, that any one thinking of going to a new resort, even for a limited stay, should first investigate the water supply.

It is said that an active person needs three quarts of

water per day. A great deal of this water is contained in the food, of course; but it is certainly true that most of us drink too little, rather than too much water.

It should be taken with meals, but, of course, washing down the food with its aid, instead of solely by means of the muscles of the gullet, is objectionable.

Oxygen

Oxygen, like water, is essential to the final development of food into energy or into actual tissue, and in this sense may be called a food. Too much emphasis, therefore, cannot be laid upon the necessity of fresh air in connection with eating, in spite of the fact that it is a text from which we preach in almost every other subject in domestic science. As Dr. Edw. Smith says, in "Foods": —

"The necessity for oxygen as a food is absolute and unintermittent. When the mixed gases of the atmosphere are received into the lungs, a portion is absorbed by the blood, and the oxygen combines with the carbon, nitrogen, and hydrogen of foods, and in all the vital processes, to form compounds. Some of these compounds remain for a time in the body, and form a part of its substance; but a far greater proportion, after producing heat, leave the body as water and carbonic acid, or other compounds, and are called *excreta*. The body is a great oxidizing apparatus, by which it sustains its bulk, produces heat, and modifies the composition of the atmosphere. When it casts off that which, having been used is no longer useful to it, it not only deteriorates the atmosphere, but renders it impure. It is not too general an expression to say that every thought and act of man, as well as every action within his body, is accompanied by the consumption of oxygen and deterioration of surrounding air."

Method. — Since the study of water has been outlined in the chapter on the Laundry, and the study of oxygen in connection with that on the Kitchen, the teacher is advised to refer to these chapters. In all probability, the best method to be pursued with the study of the inorganic constituents of food, is to teach them in reading and language lessons.

DECEMBER

FOODS (Continued):

Food Values, Dietaries, Food Economy

DRINKS:

Tea, Coffee, Cocoa

ADVANCED COURSE:

Proteids and How to Cook Them

By L. L. W. WILSON, Ph.D.,

Of the Philadelphia Normal School

CHAPTER V

FOODS (Continued)

The chart on p. 117 is self-explanatory except for the term *calories*.

A calorie in this table is the unit of the measure of energy developed as food is consumed in the body. It is the amount of heat that would be required to raise the temperature of one pound of water four degrees.

In one pound of protein and also of carbohydrates there are 1860 calories; in a pound of fat, 4220 calories. That is to say one pound of lean meat is equivalent to a pound of starch or of sugar in its capacity for giving energy. Less than half a pound of fat would yield the same amount of energy.

But we must not forget in this connection that the chief function of protein is that of a tissue builder, while the fats and starches are worthless for this purpose except as they save the protein from being consumed as fuel.

A glance at the chart shows that the best tissue builders, since they contain relatively large quantities of protein, are cheese, beef, beans, mutton, mackerel, codfish, oatmeal. Let us look at beef in detail. It contains both fuel food (fat in this case) and tissue builder (protein), but fat is difficult of digestion and to many unpalatable. It would be well then to supplement the beef with some other food in which the carbohydrates (the other fuel food) are in excess. This is true of wheat and corn bread, of oatmeal, rice, potato, and sugar. Of these the most palatable additions to

a beef diet are without doubt potato, bread, rice, beans. The same statements are true of the other meats and fish mentioned, and of cheese. Moreover, the protein of cheese is too concentrated for exclusive diet of any but hardy mountaineers.

But how about beans, oatmeal? The food stuffs represented are various enough and are in approximately the right proportions. As a matter of fact, oatmeal and milk is the main article of food in Scotland; but unless properly cooked (see starches, p. 64), it is difficult of digestion, and then so expanded by this cooking that it is difficult to swallow enough of it.

The protein in the case of beans is abundant, but at the same time it is much more difficult of digestion than the protein of meats. This is also true of the protein of oatmeal. As in oatmeal, too, long cooking is needed on account of the starches.

All things considered, meat, or fish, and potatoes, or other starchy vegetables, make the basis for the most useful and easily digested diet for man.

Even this superficial examination of the chart will suggest to most of us that our diet is not, perhaps, just what it should be. Atwater says that we make four mistakes.

(1) We purchase needlessly expensive kinds of foods. We use the costlier kinds of meats, fish, and vegetables when the less expensive ones are just as nutritious, and when rightly cooked just as palatable.

(2) Our diet is apt to be one-sided. On the whole we eat too much of the fuel foods, and too little of the tissue builders; in other words, too much oil, starch, and sugar, in proportion to meat and fish.

(3) We use excessive quantities of food. Much food is wasted and too much is often eaten.

(4) We do not know how to cook.

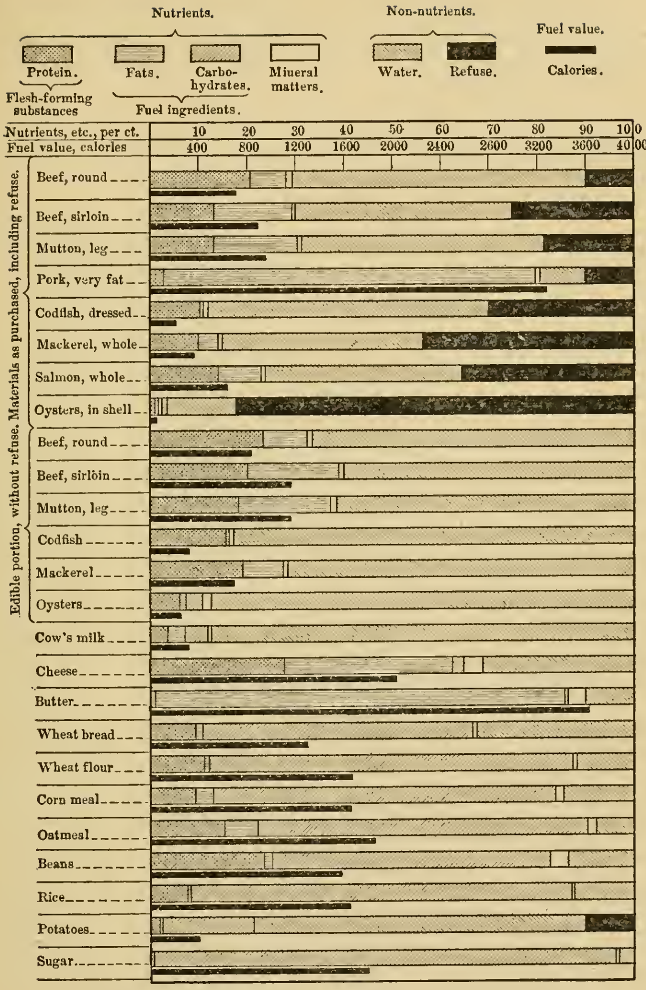


Chart I. — Composition of Food Materials

Valuable as Chart I. is, it must be supplemented by figures. Therefore the following table, also compiled from Atwater, is given:—

Composition of Food Materials

	Refuse	Water	Nutrients: Total	Protein	Fat	Carbo-hydrate	Mineral Matter	Fuel Value of 1 Lb.
Including refuse:								
Beef, round . . .	7.8	60.9	31.3	18.0	12.3	—	1.0	855
Beef, sirloin . . .	3.2	40.9	55.9	12.9	42.3	—	0.7	2025
Mutton, leg . . .	18.1	50.6	31.3	15.0	15.6	—	0.7	935
Pork	14.6	43.0	42.4	13.6	28.0	—	0.8	1435
Salmon, whole . .	35.3	40.6	24.1	14.3	8.8	—	1.0	635
Mackerel, whole .	44.6	40.4	15.0	10.0	4.3	—	0.7	370
Cod, dressed . . .	29.9	58.5	11.6	10.6	0.2	—	0.8	205
Oysters in shell . .	82.4	15.3	2.3	1.1	0.2	0.6	0.4	40
Excluding refuse:								
Beef, round . . .		68.2	31.8	20.5	10.1	—	1.2	805
Beef, sirloin . . .		42.2	57.8	13.3	43.7	—	0.8	2090
Mutton, leg . . .		61.8	38.2	18.3	19.0	—	0.9	1140
Cod		82.6	17.4	15.8	0.4	—	1.2	310
Oysters		87.2	12.8	6.3	1.6	4.0	0.9	260
Milk		87.0	13.0	3.6	4.0	4.7	0.7	325
Butter		10.5	89.5	1.0	85.0	0.5	3.0	3615
Cheese		30.2	69.8	28.3	35.5	1.8	4.2	2070
Potatoes		78.9	21.1	2.1	0.1	17.9	0.1	375
Beans		68.5	31.5	7.1	0.7	22.0	1.7	570
Rice		12.4	87.6	7.4	0.4	79.4	0.4	1630
Corn meal . . .		15.0	85.0	9.2	3.8	70.6	1.4	1645
Oatmeal		7.8	92.2	14.7	7.1	68.4	2.0	1845
Wheat flour . . .		12.5	87.5	11.0	1.1	74.9	0.5	1645
Wheat bread . . .		32.3	67.7	8.8	1.7	56.3	0.9	1280
Sugar		2.0	98.0	—	—	97.8	0.2	1820

American Dietary Standard (Atwater)

	Nutrients: Protein	Nutrients: Fats	Nutrients: Carbo-hydrates	Food Values
Man or a woman				
with little physical exercise	0.20	0.20	0.66	2450
with light muscular work	0.22	0.22	0.77	2800
moderate muscular work	0.28	0.28	0.99	3520
active muscular work	0.33	0.33	1.10	4060
hard muscular work	0.39	0.55	1.43	5700

Method. — Write on the board these words: *Animal, Vegetable,* and *Mineral.* Let the children make as long a list as possible of such foods as belong exclusively to each class. Let them make another list of articles of diet belonging partly to one and partly to another. See that these lists are fairly complete dietaries.

Which of these foods are necessaries, appearing every day on the table? Make a list of these and another of the luxuries.

Write on the board the words: *Summer Diet, Winter Diet.* Let the children arrange all the foods given in one or the other or both of these new classes.

Which list contains the most animal food? The most vegetable? Check off all that contain water.

In general, to which class of foods do the animal foods belong? The vegetable? What vegetables contain a great deal of protein? What is the function of protein? Of the starches and sugars? Of fats and oils? How much is needed of each daily? How much of each do you eat?

Show them that to discover this, it is necessary to keep careful lists of all that they eat, and in each case the quantity.

For example: — The ordinary American breakfast consists of: Fruit, Cereal, Meat or Eggs, Bread and Butter, Water, Milk.

The following weights are, of course, only approximate:

The common fruits (except the banana) are mainly water, 2 to 3 ounces. Cereal, 2 oz. With it is eaten 4 oz. milk and $\frac{1}{4}$ oz. sugar. Eggs, $3\frac{1}{2}$ oz. each. Bread, 4 oz. Butter, $\frac{1}{2}$ oz. Glass of milk, 6 oz. Water, 8 oz.

By consulting the table, the percentage of the proteids, carbohydrates, etc., in each article of diet — Multiply the quantity eaten by this percentage for the amount of each food constituent. Put down, too, the calories of available energies. For example: —

4 oz. (milk) $\times$ .87 = 3.48 oz. (water).
4 oz. (milk) $\times$ .036 = .144 oz. (protein).
4 oz. (milk) $\times$ .04 = .16 oz. (fat).
4 oz. (milk) $\times$ .047 = .188 oz. (carbohydrates).
4 oz. (milk) $\times$ .007 = .028 oz. (mineral matter).
1 lb. (32 oz.) milk = 325 calories.
4 oz. milk = $\frac{325}{8}$ C. = $40\frac{5}{8}$ C.

After computing in this way each constituent of the meal, add the several amounts and calories together. Is this a properly balanced meal? Why?

Calculate in the same way any menu given. In most cases there will be either a deficiency, or more likely, an excess, of carbohydrates. In this case the important question is, How shall we remedy the defect? Shall we add protein, or subtract carbohydrates? Why do you think so? How shall we do this? Consult Chart I.

These charts and tables may be enlarged and made permanent. The best way to do this is to have a lantern slide made from the chart or table. This will cost about fifty cents. Then, with the lantern, project this on a piece of Holland linen, chart size, hung conveniently on the wall. Dip a camel's-hair brush in liquid India ink and rapidly trace upon the linen the lines projected on it. The size of the brush depends upon the desired width of lines.

Give the children problems such as these to be worked out in the manner suggested above: —

1. What is the food value of ½ lb. of sirloin steak? Will this make a meal? Why not? With what must it be supplemented (consult chart)? Why?

2. What is the food value of ½ lb. pork? Question as in 1.

3. Of mackerel?

4. Of oysters?

5. Of beans?

6. Of rice?

7. Of bread?

8. How much milk must be taken to give nourishment enough for one day, to a man with moderate muscular work?

Economy in Food

TABLE B

Amounts of Nutrients furnished for Twenty-Five Cents, in Food Materials, at Ordinary Prices

Food Materials as purchased	Prices per Pound	Twenty-Five Cents will pay for —					
		Total Food Materials	Nutrients				Fuel Value
			Total	Protein	Fats	Carbo-hydrates	
	cents	pounds	pounds	pounds	pounds	pounds	calories
Beef, sirloin	10.00	2.50	0.79	0.38	0.41	—	2,425
" "	15.00	1.67	0.52	0.25	0.27	—	1,620
" "	20.00	1.25	0.39	0.19	0.20	—	1,215
" "	25.00	1.00	0.31	0.15	0.16	—	970
" round	8.00	3.13	0.95	0.56	0.39	—	2,675
" "	12.00	2.08	0.63	0.37	0.26	—	1,780
" "	16.00	1.56	0.47	0.28	0.19	—	1,335
" neck	4.00	6.25	1.85	0.98	0.87	—	5,500
" "	6.00	4.17	1.23	0.65	0.58	—	3,670
" "	8.00	3.13	0.93	0.49	0.44	—	2,755
Mutton, leg	8.00	3.13	0.96	0.47	0.49	—	2,925
" "	14.00	1.79	0.55	0.27	0.28	—	1,675
" "	20.00	1.25	0.38	0.19	0.19	—	1,170
Ham, smoked	10.00	2.50	1.23	0.37	0.86	—	4,340
" "	16.00	1.56	0.77	0.23	0.54	—	2,705
Salt pork	10.00	2.50	2.09	0.02	2.07	—	8,775
"	14.00	1.79	1.50	0.02	1.48	—	6,285
"	18.00	1.39	1.16	0.01	1.15	—	4,880
Codfish, fresh	6.00	4.17	0.45	0.44	0.01	—	855

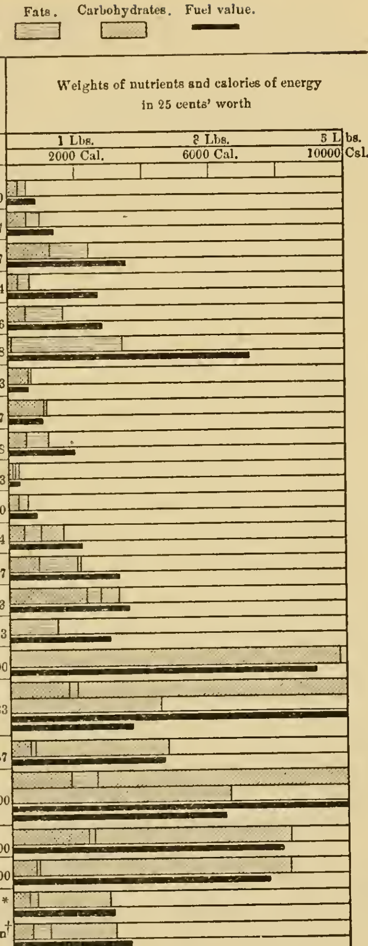
Codfish, fresh	10.00	2.50	0.27	0.27	—	—	510
" dried salt	6.00	4.17	0.68	0.67	0.01	—	1,315
" "	8.00	3.13	0.51	0.50	0.01	—	985
Mackerel, salt	10.00	2.50	0.74	0.37	0.37	—	2,275
" "	15.00	1.67	0.49	0.24	0.25	—	1,520
Oysters, 25 cents per quart	12.50	2.00	0.24	0.13	0.03	0.08	520
" 35 cents per quart	17.50	1.43	0.17	0.09	0.02	0.06	370
" 50 cents per quart	25.00	1.00	0.12	0.06	0.02	0.04	260
Eggs, 15 cents per dozen	8.80	2.84	0.63	0.34	0.29	—	1,860
" 25 cents per dozen	14.70	1.70	0.38	0.21	0.17	—	1,115
" 35 cents per dozen	20.60	1.21	0.27	0.15	0.12	—	790
Milk, 3 cents per quart	1.50	16.67	2.05	0.60	0.67	0.78	5,420
" 6 cents per quart	3.00	8.33	1.02	0.30	0.23	0.39	2,705
" 8 cents per quart	4.00	6.25	0.77	0.23	0.25	0.29	2,030
Cheese, whole milk	12.00	2.08	1.36	0.59	0.74	0.03	4,305
" "	15.00	1.67	1.09	0.47	0.59	0.03	3,455
" "	18.00	1.39	0.91	0.39	0.49	0.03	2,875
" skim milk	6.00	4.17	2.25	1.60	0.28	0.37	4,860
" "	8.00	3.13	1.69	1.20	0.21	0.28	3,645
" "	10.00	2.50	1.35	0.96	0.17	0.22	2,910
Butter	15.00	1.67	1.45	0.02	1.42	0.01	6,035
"	25.00	1.00	0.86	0.01	0.85	—	3,615
"	35.00	0.71	0.61	0.01	0.60	—	2,565
Sugar	5.00	5.00	4.89	—	—	4.89	9,100
"	7.00	3.57	3.50	—	—	3.50	6,495
Wheat flour	2.00	12.50	10.87	1.37	0.14	9.36	20,565
" "	2.50	10.00	8.70	1.10	0.11	7.49	16,450
" "	3.00	8.33	7.25	0.91	0.09	6.24	13,705
" bread	3.00	8.33	5.56	0.73	0.14	4.69	10,660
" "	5.00	5.00	3.34	0.44	0.08	2.82	6,400
" "	8.00	3.13	2.09	0.28	0.05	1.76	4,005
Corn meal	2.00	12.50	10.45	1.15	0.47	8.83	20,565
" "	3.00	8.33	6.97	0.77	0.32	5.88	13,705

TABLE B. — CONCLUDED

Food Materials as purchased	Prices per Pound	Twenty-Five Cents will pay for —					
		Total Food Materials	Nutrients				Fuel Value
			Total	Protein	Fats	Carbo-hydrates	
	cents	pounds	pounds	pounds	pounds	pounds	calories
Oatmeal	3.00	8.33	7.51	1.22	0.59	5.70	15,370
"	5.00	5.00	4.52	0.74	0.36	3.42	9,225
Rice	6.00	4.17	3.64	0.31	0.02	3.31	6,795
"	8.00	3.13	2.73	0.23	0.01	2.49	5,100
Beans	5.00	5.00	4.22	1.16	0.10	2.96	8,075
Potatoes, 45 cents per bushel	0.75	33.33	5.70	0.60	0.03	5.07	10,665
" 60 cents per bushel	1.00	25.00	4.27	0.45	0.02	3.80	8,000
" 90 cents per bushel	1.50	16.67	2.85	0.30	0.02	2.53	5,335

Dietary Standards

	Nutrients				Fuel Value
	Total	Protein	Fats	Carbo-hydrates	
	pounds	pounds	pounds	pounds	calories
Man with light exercise	1.32	0.22	0.22	0.88	2980
Man with moderate muscular work	1.55	0.28	0.28	0.99	3520
Man at active muscular work	1.76	0.33	0.33	1.10	4060



	Price per pound.	Food materials for 25 cents.
	Cts.	*Lbs.*
Beef, sirloin	25.0	1.00
Beef, round	15.0	1.67
Beef, neck	6.0	4.17
Mutton, leg	22.0	1.14
Ham, smoked	16.0	1.56
Salt pork, very fat	12.0	2.08
Codfish, fresh	8.0	3.13
Codfish, salt	7.0	3.57
Mackerel, salt	12.0	2.08
Oysters, 35 cents quart	18.0	1.43
Eggs, 25 cents dozen	14.7	1.70
Milk, 7 cents quart	3.5	7.14
Cheese, whole milk	15.0	1.67
Cheese, skim milk	8.0	3.13
Butter	30.0	0.83
Sugar	5.0	5.00
Wheat flour	3.0	8.33
Wheat bread	7.0	3.57
Corn meal	2.5	10.00
Beans	5.0	5.00
Potatoes	1.2	20.00
Standard for daily diet for man at moderate work	German*	
	American†	

* Voit. † Atwater.

CHART II. — PECUNIARY ECONOMY OF FOOD: AMOUNTS OF ACTUALLY NUTRITIVE INGREDIENTS OBTAINED IN DIFFERENT FOOD MATERIALS FOR TWENTY-FIVE CENTS

A glance at the chart shows at once that the most nutriment for the same price is furnished by wheat and corn. Next come oatmeal, potatoes, beans, rice, cheese, pork. It must be remembered, however, that potatoes, rice, and particularly pork, contain very little protein, and that one ought to be willing to pay more for animal foods since they are not only more palatable, but their protein is more digestible. Nevertheless, the prejudice of people, particularly in America, against the less expensive food is deplorable. Atwater tells the story of a butcher in the Boston markets who tried to persuade a poor seamstress that other parts of the meat were just as nutritious — and so they are — as the expensive tenderloin steak that she insisted upon having. She would not believe him and finally became quite angry at him for what she seemed to feel was almost a reflection on her character. "My wealthy customers take our cheaper cuts," he said, "but I have got through trying to sell these economical meats to that woman and others of her class."

It is interesting to note that many intelligent communities without the aid of science, by sheer instinct apparently, have solved the problem of really economical food. The Scotchmen have attained both physical and mental vigor on oatmeal, herring, and potatoes, a diet both economical and nutritious. And who will say that the high thinking of the golden age of New England had not an origin in the plain living, represented by their typical food, bread and milk, codfish and potatoes, pork and beans.

The following paragraphs are from "Food and Diet," Yearbook of the Department of Agriculture, 1894, by W. O. Atwater, Ph.D., one of his several publications that ought to be in the hands of every teacher, or family head:

"One of the ways in which the worst economy is practised is in the buying of high-priced foods. For this error, prejudice, the palate, and poor cooking are mainly respon-

sible. There is a prevalent but unfounded idea that costly foods, such as the tenderest meats, the finest fish, the highest-priced butter, the choicest flour, and the most delicate vegetables possess some peculiar virtue which is lacking in less expensive materials. Many people who have small incomes and really wish to economize, think it beneath them to use the cheaper meats and inexpensive, but substantial groceries. Many, too, labor under the false impression that the costly food materials are somehow essential and economical. The maxim that 'the best is the cheapest,' does not apply to food. The 'best' food, in the sense of that which is finest in appearance and flavor and is sold at the highest price, is rarely the most economical for people in good health. The food that is best fitted to the real wants of the user may be of the very kind which supplies the most nutriment at the lowest cost.

". . . What is here urged is that the facts are not understood, and that the ignorance results in great waste of hard-earned money. If a man has an income of $5000 a year, he can afford a tenderloin steak, oysters at fifty cents a quart, and a young chicken, and the early strawberries at the high prices that prevail when they first come into the market. He can likewise, if he wishes, pay $100 for an overcoat, and his wife may indulge in twenty-dollar bonnets. But if his yearly income is only $1000, these luxuries will be beyond his means, and if he has but $500 a year for the support of his family, such extravagance would be unpardonable. So far as the overcoat and bonnet are concerned, every one would agree to this statement; but when it comes to a matter of food economy, a great many people of small incomes would object to the principle most decidedly.

The larger part of the price of costlier foods is paid for appearance, flavor, or rarity. The sirloin of beef is no more

digestible or nutritious than round or rib, although it is more tender, and to cook it so as to get the finest flavor is an easier matter. Saddle Rock oysters, fresh from the shell, at 50 cents a quart, are worth no more for nutriment than those that are sold in the same market at half the price; and a quart of milk contains as much nutriment and in fully as digestible form as either. Salmon has no higher food value in the first of the season at $1 than later at 25 cents a pound, and at either time it ranks as food, just about on a level with mackerel, which is often sold at 10 cents per pound, or less. The expensive food materials are like the expensive articles of adornment. They are very nice if one can afford them, but they are not economical. The plain, substantial, standard food materials, like the cheaper meats and fish, milk, flour, corn meal, oatmeal, beans, and potatoes, are as digestible and nutritious, and as well fitted for the nourishment of people in good health as any of the costlier materials the markets afford.

A favorite dish in France is a soup or stew with a large quantity of peas, beans, or lentils. What nutrients does it contain? In about what proportions? Would it do for a single dish? Why? Is it economical? Why?

Ask the same question about the national dish of Italy, viz., wheat, macaroni, and polenta (corn meal) cooked with cheese made from skim milk; about the Indian and Chinese food of rice combined with peas and beans; about the *miso* the Japanese composed of rice and fermented barley, with beans or peas; about the Creole dish of rice and red beans; and corn meal, bacon, and molasses of our Southern negroes.

Method. — Much the same method may be pursued in the study of this section as has been already suggested for the previous section.

Use first Chart II, asking such questions as will lead them

to see at a glance the relative economy of the different foods. Then give them the table and let them work out problems such as these: —

(1) From the articles given in this table, select a bill of fare for three meals. Compute the cost and the food value of each. If the dietary first proposed is one-sided, make it right, and again compute the cost.

(2) Substitute equally nutritious but cheaper foods. Again compute the cost. Is the first bill of fare worth the additional cost?

(3) Suppose that a man was compelled to eat pork and beans for half his entire diet, how many pounds of beans must he eat for the requisite amount of proteid? How much carbohydrate does this quantity yield? How much pork must be added to make the food value nearly perfect?

DRINKS

Tea

Food Value. — Tea is of variable compositions. Its most important constituent is *theine*, which makes from one to four per cent. With this is combined tannin (sixteen to twenty-seven per cent). Its other constituents are caseine, gum, sugar, starch, oil, vegetable fibre, and an aromatic oil, to which its flavor is due. It has been estimated that a pot of tea as ordinarily made does not contain more than a grain of nitrogen, so that as a food it has practically no value. But properly made, and drunk in small quantities, it is a harmless stimulant, and, therefore, an aid to digestion. This does not mean that it is a suitable drink for the young. It is, in fact, very unsuitable, like every other stimulant, because of its effect on the development of the nervous system. It is useful to elderly people, and those

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with a delicate stomach incapable of digesting much food, for it prevents a waste of tissue, thus enabling the drinker to get along with less food. But it must be remembered that it does not take the place of food, and that, used in excess, it is undoubtedly a poison.

Physiological Effects. — Tea markedly increases respiration. For this reason it aids in the assimilation of food by supplying to the body a greater quantity of oxygen. As a nerve stimulant it must excite somewhat the digestive juices, but on the whole its chief value is its aid to assimilation. For this reason it should be drunk after eating rather than before, or during a hearty meal.

Its action on the skin is very noticeable, causing perspiration. For this reason it is very cooling. In popular parlance it is "the cup that cheers," and undoubtedly it has a refreshing influence on the mind. As the Chinese say, "It tends to clear away impurities, to drive off drowsiness, and to remove or prevent headache."

Customs of Drinking. — Tea is drunk clear in China and Japan, and with a few drops of lemon in Russia. In Tartary and on the coast of South America, the used leaves are passed around and eaten with relish. These contain about twenty per cent of nitrogenous matter, so that the custom can certainly be defended on the score of economy.

Natural History. — Tea is the dried leaves of a plant belonging to the same family as our camellia. It is now a shrub, but a wild variety, supposed by some to represent the original stock, attains the size of a large tree. It is one of the hardiest of subtropical plants, and will grow over a wide area of country. The conditions best suited to it are the slopes of mountains in tropical or subtropical countries. These give it the warm, moist, equable climate with good root drainage under which it thrives best.

It is grown from seed. As soon as the plants are four or

five inches high they are transplanted to the plantation. The rows of plants are five feet apart, so that the pickers can walk easily between them. If the situation is exposed, the plant is kept low, that it may not be injured by the storm and wind, but in sheltered positions it is allowed to reach a height of six feet or more. When the slope of the ground does not shelter it, it is usual to plant near by quick-growing trees to break the force of the wind.

For three years it is allowed to grow undisturbed except for needed pruning, and even then care is taken not to strip it, for the leaves are the main organs of this as well as other plants.

Preparation for the Market. — The leaves are picked three times a year. Those gathered first, in April, are considered the choicest, for they contain a larger proportion of juice in relation to the solid, and are moreover much more pliable. A large portion of this crop is kept in its habitat for the use of the wealthy; but some of it finds its way in small quantities on the backs of horses or caravans to Russia, and of late years a little of it is sold in the markets of Great Britain and the United States.

Women and children are employed in gathering the leaves. It is worthy of note that the fresh leaves have neither odor nor flavor. These leaves are then dried in the sun and trodden out by barefoot men, in order to break the fibres and dry them better. Then they are heaped up and heated for some hours, or until they are reddish brown in color. They are then rolled up by hand. This is to start up fermentation, which, however, is soon checked by exposing them to the heat of the sun, or else baking them over a charcoal fire. In all this heating they are carefully stirred to prevent scorching.

In this state they are bought by the merchants, who in turn sort them so that leaves of the same size and age

shall be together. Stems and damaged leaves are removed. Then they are thoroughly dried over a slow fire and are shipped to Europe and America.

It is said that the Chinese will not drink tea until it is a year old, but since its flavor depends on a volatile oil, it is evident that new tea must be better than old. Moreover, the longer that the tea is packed in the close hold of a vessel, the more likely it will be to ferment. Therefore, exceptionally fast vessels have been built for the tea trade in England, and there is always a great strife to be the first ship to bring the new cargo in.

Kinds of Tea. — Tea may be roughly divided into green, black, and scented.

The process of preparing black tea has been already given in detail. Green tea is not dried in the sun, but with artificial heat. It is because of this rapid drying that it retains its natural green color.

Scented tea is always of mediocre quality. Its odor is due to its being mixed with the aromatic leaves of other plants.

History. — The word tea is of Chinese origin. This is due to the fact that it was first cultivated in China. When it was first imported into England (1665) it was sold at the rate of $15 a pound. Excellent quality can now be bought for fifty cents a pound.

Its cultivation has spread into India, Ceylon, Japan, Korea. Its cultivation in other countries has not been particularly successful, for cheap labor is as essential to successful tea-growing, as favorable climate, soil, and situation. It will be observed that the great part of its manufacture is carried on by hand.

Substitutes for Tea. — Substitutes for tea have been used in almost every country. Appalachian tea, New Jersey tea, Mountain tea, Labrador tea, Oswego, are the names of

some of the teas prepared from native plants, some of them used by the Indians, and many of them, doubtless, by the colonists during the memorable times of the tea tax. Maté tea, made from the leaves of the Brazilian holly, is much used in South American countries. It is prepared similarly to Chinese tea, and is cooked in much the same way. The natives flavor it with lemon and burnt sugar, and suck it through a straw. It is a slight narcotic, resembling coffee rather than tea leaves. It is very cheap, and is therefore drunk in large quantities.

Preparation for the Table. — In preparing tea for the table, the aim should be to extract all the aroma and the theine with the least possible admixture of tannin. This is accomplished by pouring over the tea freshly boiled water, letting it infuse for at least five minutes. Longer infusion depends upon the taste of the drinker for tannin.

The Chinese directions with regard to water and fire were as follows: —

"Take the water from a running stream; that from hill springs is best, river water is the next, and well water is the worst. The fire must be lively and clear, but the water must not be boiled too hastily. At first it begins to sparkle like crabs' eyes, then somewhat like fishes' eyes, and, lastly, it boils up like pearls innumerable, springing and waving about."

Method. — Distribute to each student a small quantity of tea. Ask them what it is and why they think so. Let each pour boiling water on her tea and watch the result. What is tea, then? Give them some account of the tea plant, its culture and manufacture.

Let them taste the water in which the leaves have been standing. Let them boil it for five or ten minutes and taste again. What is the difference in the taste? To what is the flavor due in the first instance? In the

second? For what other purpose is tannin used? (Tanning leather.) How then, should tea be made?

What is its food value?

What is its effect on the nervous system? By whom, then, should it not be drunk? What are its advantages?

Exhibit samples of various teas,—letting the pupils arrange these according to their commercial value.

Recipes for Pupils

A Cup of Tea.—Pour boiling water in the teapot; when the pot has become thoroughly heated, empty it. Put one teaspoon of tea into the hot pot, and pour one cup of freshly boiled water on it. Let it steep five minutes and then serve. If too strong, dilute with boiling water. If the tea has to stand, pour off the tea from the leaves. Serve plain with a sweet cake, as do the Chinese and Japanese; or with cut sugar and slices of lemon, Russian fashion; or in the ordinary way, with cream and sugar.

A Cup of Tea (second method).—Pour a cup of cold water over a heaping teaspoonful of tea. Let it stand all day in the refrigerator. Pour off the liquid, heat, and serve as desired.

Tea made in this way is much to be preferred to any other for iced tea.

Coffee

Food Value.—Roasted coffee contains about one per cent of *caffeine* (a principle analogous to theine); about thirteen per cent of peculiar aromatic compounds, developed in the roasting from the oils and fats of the green berry; about six or seven per cent of sugar (caramel). Caffeic acid, in its physiological effect similar to tannin, is present in small quantities (three to five per cent). It contains, also, not far from thirteen per cent of proteids, a small quantity of min-

eral matter, and about sixty-nine per cent of burnt cellulose. The berry itself, then, is more nutritious than the leaves of the tea; but the infusion which is usually drunk is a stimulant, rather than a food.

Natural History. — Coffee is the seed of a berry of a tree which, wild, attains a height of twenty to thirty feet. In cultivation, however, it ranges from three to six feet, thus making it possible to gather the abundant fruit with ease.

It belongs to the same family as the Peruvian bark from which quinine is made.

It is an evergreen, with numerous beautiful jessamine-like white flowers. These bloom for eight months of the year, producing a succession of crops of fruit.

Coffee, like tea, needs a warm, moist climate, rich soil, and protection from winds and storms. The original home of Mocha coffee has the finest climate in the world for coffee culture. All the year round a thick mist ascends from the coast to the slopes on which the coffee is growing. At the time of the greatest heat, midday, this mist protects the plants from it; and at night the hot air ascending from the plains keeps the temperature marvellously equable. It is a natural, self-regulating hothouse.

Preparation for Market. — During the height of the season, each coolie is expected to bring a bushel of berries to the pulping mill at midday and again in the evening. This fruit resembles in color and texture a small cherry, but instead of one stone it contains two seeds. These seeds are enveloped in a thick leathery skin called parchment. After the berries have been pulped by machinery they are cured by exposing them to the sun for six or eight days. Great care is needed, because they are now extremely sensitive to rain or dew. When thoroughly dried, they are sent to the coffee works in bushel bags. Here they are placed in circular troughs and subjected to the pressure of heavy rollers, which

break the parchment but do not crush the berry. This outer covering is fanned away and the berries sized. This is necessary on account of the roasting. A small bean would be burned to charcoal before a larger one was thoroughly roasted. The smallest berries, no matter where grown, receive the trade name of Mocha and command the highest price. Nineteen-twentieths of the Mochas and Javas of commerce come from Brazil, and it is many years since real Mocha has reached Europe or the United States.

It sometimes happens that instead of two flat seeds, the berry will have one round one. These are carefully sorted out and sold in market under the name of male berry or pea berry coffee. It is supposed to have a finer flavor than the common varieties, and for that reason commands a higher price.

History. — The legend of its discovery is quite interesting. It is said that a poor Arabian dervish noticed evening after evening that his goats returned home in remarkably happy humor. He watched them closely to find out if he could the cause of their joyfulness, and discovered that they ate eagerly the leaves and flowers of a beautiful unknown tree. He tried the effects of these on himself. He was so exhilarated that his neighbors accused him of drinking wine, forbidden to them; but when he told them of his discovery, they agreed with him at once that it was a plant sent by Allah as a substitute for the forbidden wine.

The Mahometans used it to keep themselves from going to sleep during their long hours of prayer. For this reason its use was opposed by many of the priests, who tried in vain to have it brought under the prohibition of the Koran which was directed against intoxicating drinks.

Physiological Effects. — Coffee, unlike tea, decreases the action of the skin, and is not, therefore, accompanied by the free perspiration so characteristic of tea. It increases res-

piration, the action of the heart, and excites the mucous membranes. This in addition to its slightly greater food value makes it better fitted for the feeble than tea. Because the skin is most active and the heart most feeble in the morning, it is preëminently a breakfast drink. It is not so good after dinner, and if taken then should be drunk soon after the meal.

Adulterations. — Unground coffee is not easily adulterated; but ground coffee is very frequently mixed with ground chicory, dandelion or carrot roots, or ground peas and beans.

To detect these adulterations put a few grains of the suspected coffee on the surface of water in a glass tumbler. If chicory is present, it will be surrounded by a yellow brown cloud which will soon color the whole tumbler of water.

Caramel colors the water much more deeply, and dandelion root or rasped bread less deeply. Beans and peas, on the contrary, color the water much less deeply than pure coffee even, so that the color scale increases in intensity in the following order: Peas or beans, rasped bread or dandelion, coffee, chicory, caramel. Dandelion root may be detected by tasting it, and bread, of course, will soften in the mouth.

Pure coffee will not color cold water in less than fifteen minutes.

Preparation for the Table. — The most economical way to buy coffee is raw. It must be kept dry, but it improves with age.

To roast it, use quick heat. This develops the flavor and makes it brittle. It may be ground in a coffee-mill or pounded in a mortar to the required fineness.

In cooking it the point is to make an infusion which will contain the essential oils and the caffeine. This may be

accomplished by letting it stand for some hours in cold water, bringing it to a boil just before using it. Although this is the most economical way, boiling it and filtering it are the more usual methods.

Method. — Procure from any grocer samples of the different coffees raw, roasted, and ground. Coffee in the "parchment" and even in the pulp may sometimes be procured from wholesale grocers who keep them as curiosities and are willing to loan or give them away. Pictures of the tree and of the various stages of manufacture are easily found, and with small classes add to the interest of the lesson.

With this material develop so much of the natural history, manufacture, and history of coffee as you deem expedient.

Teach its physiological effects.

Ask them to find out the market price per pound of Mocha, Java, Mexican, Maracaibo, Bogota, Jamaica, Rio and other common commercial varieties. Is it costly enough to warrant adulteration?

Let them test pure coffee as suggested above. Give them experience in testing the various adulterants. This is most safely done by giving them coffee that you have yourself adulterated. Here again the friendly wholesale grocer will prove invaluable.

Let them make coffee in the various ways suggested. Calculate the cost per cup in each case, and carefully note the difference in flavor.

Recipes

Infused Coffee. — To one tablespoon of finely ground coffee, in a covered earthenware jar, add a cup of cold water. Stir until all the coffee has been wet. Cover and let it stand for

several hours. Just before it is needed for use, bring it gradually to a boil.

Boiled Coffee. — Have the coffee ground medium fine. Rinse the coffee-pot, and allow one heaping tablespoon of ground coffee to each cup of boiling water. Stir well together and pour on the boiling water; let the coffee boil two minutes. Set the pot back on the range, where it will not boil, but keep below the boiling point for ten minutes. Pour a little off into a cup and then back again; do this twice, and then pour one tablespoon of cold water down the spout to perfect the settling and clearing. It will then be ready for the table in ten minutes.

Egg is not essential to clear coffee, and the common practice of putting in dirty egg-shells cannot be too strongly condemned.

Filtered Coffee. — Coffee to be filtered must be ground very fine.

Use one heaping tablespoon of coffee to each cup of boiling water. Put the coffee in the strainer and pour the boiling water in it; as it drips, keep adding water until the desired quantity has been added. This coffee must not be allowed to boil, but is ready for the table as soon as filtered. Have the coffee-pot hot, and keep it hot during filtration.

The simplest form of a strainer to hold the coffee is a flannel or cheese-cloth sack suspended in the pot. For the individual recipe a strainer in which is put filter paper will answer every purpose.

Cocoa

Food Value. — The cacao bean contains fifty per cent of fat, thirteen of proteids, seven of a tannin-like principle, four of starch, and about one per cent of *theobromine*, a principle allied to theine and caffeine. Chocolate is the

whole bean, crushed and pulverized; but about half of its fat is extracted in the manufacture of cocoa. Therefore, cooked in milk, as it usually is, cocoa is an excellent food, partaking rather of the nature of a nutritious soup than of a drink.

Natural History. — The cacao bean of commerce is the seed of a fruit from six to ten inches in length, and containing from twenty to thirty seeds. The color varies according to the degree of ripeness, from yellow to red, and at last purple.

The tree succeeds best in a moist tropical climate.

Preparation for Market. — The fruits are buried in damp earth with green leaves until they ferment. So much heat is developed during this process that the hand cannot be held in the heap even for an instant. Afterward the beans are dried in the sun, or else roasted by machinery. They are then crushed and broken up into small pieces, the cocoa-nibs of commerce. From these is made the chocolate and cocoa of commerce, the latter usually being freer from oil. The oil expressed from the nibs in the preparation of chocolate and cocoa is utilized in the making of cocoa butter, used in some places for cooking, although known to us on the fingers of the *masseur*.

History. — When the Spaniards first lived in Mexico, they found the Mexicans drinking a decoction from the cacao bean, called by them chocolatl. It was speedily introduced by them into Europe, and was used there as a beverage before the introduction of either tea or coffee. In Spain it was soon regarded as almost a necessity, but has never been so highly esteemed in other countries. Nevertheless, the great botanist, Linnæus, was so fond of it that he named the tree from which it grew *theobroma*, — food of the gods.

Adulteration. — Cocoa is quite commonly adulterated with starch. This may be easily detected under the microscope

by those who are familiar with the peculiar appearance of starch granules.

Preparation for the Table. — Unlike tea, or even coffee, cocoa must be boiled to be agreeable. The infusion of cocoa made by steeping without boiling is bitter and unnutritious.

Method. — From wholesale grocers may be obtained easily all stages in the manufacture of chocolate except the tree and fruit itself. Supply this lack with pictures. With the aid of these develop the natural history of the plant and its preparation for market.

Teach its food value.

Recipes

A Cup of Chocolate. — Break into small pieces one bar of Maillard's chocolate. Add this to a cup of cold milk in the double boiler. Place it on the stove and stir constantly with a wooden spoon until the chocolate is dissolved. Let the milk boil for an instant. It should be beaten and served with whipped cream.

If Baker's chocolate is used, shave down a square and dissolve it first in a little cold water.

A Cup of Cocoa. — Dissolve a teaspoonful of cocoa in a little cold water. To this add a cupful of boiling milk and let it boil for a minute, stirring vigorously all the time.

CHAPTER VI

ADVANCED COURSE: THE PROTEIDS, AND HOW TO COOK THEM

For Fish, see Chapter VIII.

Many of the recipes in this chapter were contributed by Mrs. Ada Byron Fink, in charge of the lunchroom of the Philadelphia Normal School.

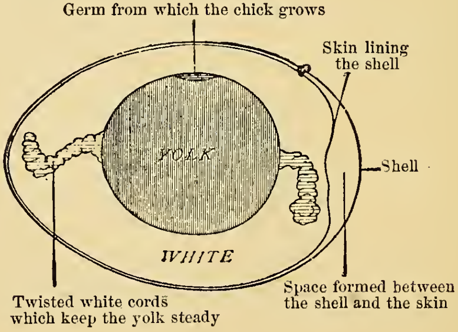
BIBLIOGRAPHY

Works recommended in Chapters IV, V, VII, and VIII.

Facts. — These have been given in chapters on Foods and on Principles of Cooking.

The proteids are especially abundant in eggs, milk, meats, fish, and the leguminous vegetables.

In addition to the facts to be found in the chapters on Foods, the following may be useful in the study of materials, preliminary to the cooking lessons.



Eggs. — This drawing will make all the parts of the egg clear. It might be placed on the board when the students have thoroughly worked out the various facts demonstrated by it with the eggs themselves. Their average composition is as follows: —

	Per Cent
Refuse (shell and skin)	13.7
Water	63.1
Protein	12.1
Fat	10.2
Mineral matter	00.9
Calories (per pound)	655.0

As will be seen from an inspection of Chart II, at twenty-five cents a dozen, they are expensive food.

Milk has been already discussed with sufficient thoroughness for the purpose.

Meats are from the cow, calf, sheep, lamb, pig, birds.

Beef. — The total amounts of nutrients, the calories, and the relative economy of the various cuts are as follows, the analyses having been made from cuts just as they are purchased in the markets (Atwater).

Beef	Total Nutrients Per Cent	Calories	Cost per Lb.	Amount of Nutrients for 25 cts.
			cents	
Neck	30.4	880	8	0.95
			6	1.27
Chuck ribs	35.9	1125	16	0.56
			12	0.75
Ribs	40.8	1405	22	0.47
			18	0.57
Brisket	45.1	1580	—	—
Cross ribs	49.2	1765	—	—
Shoulder	31.6	895	14	0.57
			10	0.79
Shin	15.7	310	—	—
Plate	45.7	1600	—	—
Navel	46.4	1610	—	—
Sirloin	32.2	970	22	0.37
			18	0.45
Socket	27.5	880	—	—
Rump	45.5	1570	18	0.63
			15	0.76
Round, first cut	31.5	855	18	0.44
			15	0.52
Round, second cut	20.7	505	10	0.52
			8	0.65
Leg	10.5	235	—	—
Top of sirloin	55.9	2025	—	—
Flank	64.2	2435	15	0.74
			10	1.11

From this table it is evident that of the usual cuts one gets the most for one's money in the neck and in the flank, next in the shoulder, then in the rump, chuck rib, second cut of the round, ribs, first cut of round, and last the sirloin.

Veal. — The flesh of veal should be firm, and its color pink. The bones, too, must be hard. "Bob" veal, as it is called, may be easily recognized by its flabby flesh of a blue tinge. It has been killed too young and is very unwholesome.

The shoulder alone contains 24.8 per cent of nutrients and 570 calories; the shoulder and fore shank together contain 26 per cent of nutrients and 715 calories.

Mutton. — The neck is used for stewing, the shoulder roasted, the leg boiled or roasted, the saddle roasted, and the chops broiled.

Cuts of Mutton	Per Cent of Total Nutrients	Calories	Cost per Lb.	Amount of Nutrients for 25 cts.
			cents	
Shoulder	34.7	1075	20 15	0.44 0.58
Neck	32.1	1055	—	—
Hock	36.4	1160	—	—
Leg	31.3	935	25 20	0.31 0.39
Loin	42.7	1480	—	—
Flank	60.0	2145	—	—

This table shows the total amount of nutrients, the calories, and the relative economies of the various cuts (Atwater). As in the previous table, the last column is of particular interest.

Lamb. — The meat is at its best when it is two months old. It is sold by the quarter. The hind quarter is the most expensive, but the fore quarter contains a larger per cent of nutrient and more calories.

Pork.

Pork	Total Nutrients Per Cent	Calories	Cost per Lb.	Amount of Nutrients for 25 cts.
			cents	
Shoulder roast	42.4	1435	—	—
Ham smoked.	51.8	1735	16	0.81
			12	1.08
Sausage	58.8	2065	15	1.46
			12	1.83

This table, like the others, is taken from Atwater, and is based on cuts as bought in the market.

Poultry. — Turkeys contain more nutrients than chickens.

The legumens, beans, peas, etc., contain the greatest amount of protein and at the least cost, as will be seen on consulting Charts I and II in the chapter on Foods. On the other hand, the protein contained in them is less digestible.

Review *Boiling*. See chapter on Principles of Cooking.

Practice.

Eggs

What is the composition of the white of an egg? Of the yolk? What effect will long continued boiling temperature have upon yeast? What disadvantage will this be in the ultimate cooking? What will be the effect of too great heat? Too little? What is the optimum temperature for boiling an egg? What two ways may this be obtained?

Write a recipe for boiling an egg.

Boiled Egg. — I. Place an egg in a saucepan. Cover with cold water, bring the water slowly to the boiling point, letting it boil a few seconds.

II. Cover an egg, first with warm water, and then with boiling water. Let the water, cooled by the addition of the egg, again come to a boil. Cover, and remove the saucepan from the fire. In five minutes the egg will be sufficiently cooked.

Poached Egg. — In a saucepan, put a muffin ring. Cover it with boiling water. Add a pinch of salt. (Why ?) Into this ring carefully drop an egg. If the yolk breaks, reject it. At once set the pan to one side, and let the egg cook until the yolk has set and the white is translucent and a firm jelly. This will be in about fifteen minutes. In the meantime get ready pieces of toast somewhat larger than the rings. Moisten the crust with hot water, spread with butter. Lift and drain the eggs carefully with a skimmer, placing them on the square of toast. Remove the ring and garnish with a bit of green.

Mutton

From what animal is mutton obtained? What parts of the sheep are cooked? How? Should it be well done or rare? What sauce is served with it? What vegetables may be boiled with it? Which will take the longer to cook? At what temperature is albumen coagulated? What objection to immersing the leg of mutton at once in water 165° F? What should we do? Why? Write recipes.

Recipe for Boiled Mutton. — The fat of mutton is apt to be strong. Therefore trim off a part of it. Put the leg in enough boiling water to cover it. Let it boil fifteen minutes. Put the pot to one side and let it simmer for a length of time depending upon the size, allowing fifteen minutes to the pound. Half an hour before it is time to take off the meat, add a carrot and a turnip, cutting each into thick slices. In the meantime make ready chopped parsley or

capers and a white sauce (see white sauce in Starchy Foods, and egg sauce in chapter on Fish). Put the mutton on a warm dish, smear it evenly and smoothly with white sauce, and sprinkle over it the chopped parsley. Garnish with the vegetables and serve with caper sauce.

Shall we throw away the water? Why not? What does it contain besides the extraction of the meat? What can we do with it?

For an individual recipe for boiled mutton, give the children each a small chunky piece, and cook as indicated in the full recipe given above, using the individual white sauce given in the chapter on Starchy Foods. Care should be taken to see that the meat is always just covered with water and no more.

Recipe for an Economical Soup. — Add to such water the left overs that have been accumulating in the stock pot, viz., bones (these must be broken up), gravy, spoonfuls of vegetables, pieces of meat. Let this compound simmer for five or six hours. Strain into a bowl and leave uncovered to cool. Remove the grease, and use as stock with rice or vegetables for soup.

Recipe for Floating Island ($\frac{1}{6}$). — Put in a double boiler one cup of milk. Scald, but do not boil. Take it from the fire, adding it slowly, stirring all the time, to the slightly beaten yolk of two eggs, to which a tablespoonful sugar and quarter of a saltspoon of salt have been added. Replace on the fire, stirring constantly until it is smooth and creamy. If it begins to grain, put the pan in cold water and beat vigorously with a Dover egg-beater. Return to the fire. When it coats the spoon, strain it into two cold cups and add ten drops of vanilla.

Beat to a stiff froth the white of the egg, divide it between the two custards, and set in the oven for a moment to brown.

Why is a custard cooked in a double boiler? What does the graining mean? Why is it plunged into cold water? What is the philosophy of beating it?

The proportions for a full recipe for custards are as follows: 5 to 8 eggs; 1 quart milk; 1 saltspoon of salt; 1 teaspoonful vanilla.

Steaming or Braizing. — Instead of surrounding the food material with water, steam may be the cooking medium. It is an excellent way to cook the less expensive cuts, as, for example, the under side of the round, and depends for its success on long, slow cooking.

Recipe. — Mix $\frac{1}{4}$ cup each of diced salt pork, carrot, turnip, onion, and celery together. Spread all except a half cupful in the bottom of a baking pan. On this bed of vegetables place a chunky three-pound piece of beef from either the upper or the lower round. Dredge it with flour. Place it in a hot oven to sear the outside. This will take from 20 to 25 minutes. Now add two cupfuls of water, a bunch of pot-herbs, and half a teaspoonful of salt. Spread the half cupful of vegetables over the meat. Cover it closely with another pan. Shut off the drafts and let it cook very slowly from four to five hours. The sauce already formed in the pan needs only to be strained and seasoned with salt and pepper. Serve with or without the vegetables.

Practice. — Review *Stewing.*

Old Fashioned Lamb Stew ($\frac{1}{3}$). — Take one pound of neck meat of a yearling. This is very rich meat, but the presence of the vertebræ makes it difficult to manipulate. It should be sawn through, not chopped, but it is usually necessary first to educate the butcher to this and other niceties. (Why is it necessary to cut it into small pieces?) Add an onion cut in pieces, and enough cold water to cover the

meat. Cover closely; bring it to the simmering point and let it simmer for a couple of hours. (Why was cold water added? Why is it kept at simmering instead of boiling temperature?) With so small a quantity of meat it will be necessary to watch it and add water as may be necessary. Now add to the meat $\frac{1}{3}$ the quantity of halved potatoes, a few slices of carrots, and salt and pepper to taste. Recover, and let it boil another hour. (Why were not the vegetables added in the beginning?)

Many people *sauté* the meat used in the stews. This is a poor method. Not only is it more trouble, but it certainly gives both a less digestible meat and less flavoring broth.

Fricasseed Chicken. — The chicken need not be young. It must be drawn at once.

To Draw a Chicken. — Remove the pin feathers, and then singe the chicken. Use lighted paper or alcohol. Every part of the fowl must be exposed to the flame. This may be most easily done by holding it by the head and feet and turning it constantly.

Wash the outside of the chicken thoroughly with plenty of water and a cloth. The skin should be scraped with a dull knife, for it is full of dirt from exposure and handling.

Cut off the head, cut the skin down the back of the neck and turn it over. Remove carefully the crop and windpipe. Now cut off the neck close to the body, folding the skin over the opening. The neck should be saved for the stew.

Bend the leg back slightly and cut the skin on the joint. This will expose the tendons. Run a fork under them and draw them out. Break off the leg at the joint with the tendons hanging to it. Save these for the stock pot.

Cut a small opening under the rump, anterior to the vent. With the finger loosen the viscera from the body. Repeat this process in the neck opening. Cut a circle around the vent. Now draw out the viscera in one mass without break-

ing any portion of it. If either the gall or the intestine should be broken, wash it out at once. In any event the interior must be wiped out with wet cloth. Cut the gall from the liver; cut open the gizzard, removing the inner sack entire; open the heart and wash away the blood clot.

On the back of the rump will be found the oil sack which keeps the feathers in good condition. As it is rather strong in flavor, cut it away.

In teaching the children how to draw a chicken, lead them to reason out each step in the work. For example, show them the chicken. What should be removed? How? Scrape the skin with a dull knife, showing them the dirt. What shall we do next? How?

What organs are within the body of the chicken? Will it do to let these remain? Why not? Show them a dissected fowl, or a diagram of one. Where will it be easiest to withdraw the crop and windpipe? The other organs? How shall we do this?

Examine the viscera. Which parts are used in cooking? How shall we prepare each? Why? What does the gall contain? What is its function in digestion? Cut open the inner sack of the gizzard. What does it contain? Why? Why do birds have gizzards? (Examine the mouth and consider the food for the answer to this question.)

What is the protuberance on the upper side of the rump? What is its function? Shall we remove it? Why?

Write directions for cleaning and drawing a fowl, illustrating it with diagram.

Recipe. — Cut off the two drumsticks, the two second joints, the two wings, two pieces of breast. Divide the back into three pieces. Cover with cold water and bring slowly to a boil. Set it back where it will simmer. Add to

it a few slices of salt pork and a bunch of pot-herbs. Cover, and let it simmer until quite tender. The time depends upon the age of the chicken.

Put the pieces on a warm dish, arranging them neatly. Strain the water in which it was cooked, removing all grease. Use a cupful of this to make a white sauce (see chapter on Starchy Foods). If care has been taken not to add more water than will cover the meat, there will not be much more than enough fluid. If there is, evaporate it quickly to the required amount.

Veal Pot-pie. — Use the method and recipe given for a lamb stew.

Cook the dumplings in a separate pot with plenty of water, or else in the same pot with the meat. In the latter case care must be taken that the water does not cease to bubble while they are in.

Dumplings ($\frac{1}{4}$). — Mix together $\frac{1}{2}$ cup flour, 1 saltspoonful of salt, and $\frac{1}{2}$ teaspoonful of baking powder. Stir in quickly $\frac{1}{2}$ cupful of milk. Drop the soft dough from a spoon into boiling water. It will take ten minutes to cook them. They must be served as soon as they are taken from the pot.

Review *Extracting*.

Stock. — One recipe has already been given under boiling.

Brown stock is made from beef, either alone or with other meats, and mixed vegetables.

White stock is made either from veal or chicken, alone, or both together. It is seasoned with onion, celery, white pepper and salt.

Soup meats are the lower round, the shin and the neck of beef, and the knuckle of veal.

The proportions are a quart to a pound, and one vegetable. The vegetables used are onions, carrots, turnips, and

celery. It is usual to make at one time from four to eight quarts, and add a bunch of pot-herbs to this quantity.

These facts, plus a knowledge of the principles of extracting, ought to enable any one to write a recipe.

Stock. — Procure a four-pound piece of a shin of beef. This should be well broken by the butcher. Take off the lean meat and cut it into small pieces. Put all into a perfectly clean pot which has been washed in soda and scoured clean. Add to the meat four quarts of cold water. Let it stand half an hour, and then bring it slowly to a boil. In the meantime, wash, scrape, and cut the vegetables (turnip, carrot, onion, stalk of celery) into small pieces. Add these to the pot, and set it where it can simmer for five or six hours. Add two teaspoonfuls of salt just before removing it from the stove. Strain it into an earthen bowl, and cool at once. When used, remove carefully the layer of grease; salt and pepper it to taste.

From this stock may be made macaroni, noodle, vermicelli, vegetable, julienne, and tapioca, by adding to it just before serving the boiled vegetable indicated by the name. In julienne soup, the vegetables are in two-inch shreds. A knife comes for the purpose of cutting these.

Review *Roasting*. In roasting meat what is done with reference to the temperature, to prevent the escape of the juices? Explain. Why may not this heat be continued during the whole cooking? Which requires the more intense heat at the beginning, a small, or a large roast? Why? How can you regulate the temperature of the oven? Explain.

Recipe. — Choose a rib roast, well streaked with fat, and bright red in color. Wipe it with a damp cloth. (What is the objection to washing it?) Place it in the rack of the roasting pan. Dredge it with flour. (Why?) In the

corner of the pan put two tablespoonfuls of drippings, half a teaspoonful of salt, and a saltspoonful of pepper. The salt, at least, must not touch the meat. (Why?) Put it into a very hot oven until the surface is seared and brown (about twenty minutes). Lower the temperature of the oven by shutting off the drafts. Baste frequently with the liquid in the pan, to which a cup of water may be added. For rare meat, eight minutes to the pound will be usually sufficient.

Good cooks often refuse to put water in the pan, saying that the steam from it keeps the roast from browning; but the roast should be browned in the first heating. Adding hot fat continually to the surface makes it less indigestible, whereas the water lowers the temperature, allowing the meat within to cook slowly.

Gravy. — Pour off all the fat from the pan. Add one cup of water. Season to taste, with salt and pepper. Mix one teaspoonful of flour with enough cold water to make a smooth paste. Brown it in the oven. Stir it into the boiling water. Let it boil for five minutes, stirring all the time. Strain, and serve in a hot dish.

Baked Custards

What are the ingredients of custard? What temperature does milk require for boiling? What difference in the general temperature of the oven for baking a custard than from that required in roasting meat? Is it necessary to have a preliminary high temperature? Why not? What precaution did we take against too great heat in cooking boiled custard? How can we apply this principle in baked custards?

Recipe. — Use the same proportions and methods as in boiled custard. Turn the mixture into two cups. Grate a little nutmeg over the top. Set them in a dish of hot

water in a moderate oven. Cook until the centre is firm. This may be tested by running a knife into it. If it comes out clean, it is cooked enough.

If it has been baked slowly, at a low temperature, it will be solid and smooth. If it is full of holes, then the temperature of the oven was too high. This converts the water into steam, which finally escapes, but leaves behind the holes made in its formation.

Review *Broiling.*

Recipe for Broiled Beefsteak. — If a tough cut is used, pound it before broiling, or else brush it on both sides with a mixture of one part vinegar and two parts oil, letting it stand at least two hours before cooking. The vinegar, held in check by the oil, partially dissolves the tough fibre.

Cut off the superfluous fat and, if it is a sirloin or porterhouse piece, remove the end. (Where shall we put the fat? The end?) Make the surface smooth by striking it with the broad side of the knife.

The broiler must be very hot. Put a piece of the meat fat on the end of a fork and grease it well. Put the steak between the broiler, and near clear hot coals. Turn every ten seconds. When done, it will be puffed up between the wires. (Why?)

A steak an inch and a half thick will require about eight minutes of cooking. Sprinkle with salt and pepper, and spread with butter. Serve at once.

Chops and steak, too, *may* be broiled in a frying pan, by removing all fat, putting them in a dry, red-hot pan, and turning with a skimmer, allowing them to cook more slowly when the outside is seared.

Review *Frying.*

Croquettes

These may be made from the chopped meat of chicken (white meat, or dark meat, or both together), of veal, of sweetbreads and mushrooms, of fish, of soup meat, etc.

Individual Recipe. — To the white sauce (see chapter on Starchy Foods) add half a cupful of chopped meat, seasoned with saltspoonful of salt, same quantity of onion juice, a dash of pepper and a dash of nutmeg. Pour the mixture on a dish and set it aside for at least two hours. Then take half the mixture and roll it lightly into a ball. On the moulding board spread a plentiful supply of bread crumbs, spread evenly. Roll the ball on these, into a cylinder, flattening the ends by dropping it lightly on the board.

To $\frac{1}{4}$ the white of one egg, add a teaspoonful of water, stirring. Moisten the croquette thoroughly with this, using a spoon for the purpose. Lift it with the blade of the knife, and again roll it in the crumbs. See that every part is thoroughly covered. Set them aside for at least an hour before frying.

They are now covered completely with a thin layer of albumen. This the heat will coagulate, and it will be impossible for the grease to soak in.

To fry them, have ready a kettle of olive oil or cottolene. When it is *smoking* hot (why?) put the croquettes on the basket, and immerse them completely. (Why?) A long iron or wooden spoon, on which to hang the basket, will save the hand from being spattered with the burning fat.

Let the croquettes stay in the oil only as long as is necessary to brown them. Raise the basket and let them drain for a moment. Place them on brown paper in the open oven.

If the moulding and frying have been done properly, they

will be so free from grease that they may be served in a white napkin.

By sauté is meant the usual form of frying in a shallow pan with a little fat. It is, for reasons given under *Frying*, in the chapter on Principles of Cooking the most objectionable way of cooking.

JANUARY

PRINCIPLES OF COOKING

By L. L. W. WILSON, Ph.D.,

Of the Philadelphia Normal School

ADVANCED COURSE: FISH, OYSTERS, AND SALADS

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Many of the recipes for this chapter have been specially prepared by Mrs. Ada Byron Fink, in charge of the lunchroom of the Philadelphia Normal School.

CHAPTER VII

PRINCIPLES OF COOKING

By L. L. W. WILSON, Ph.D.

Uncivilized man takes his nourishment like animals — as it is offered by Nature. Civilized man prepares his food before eating and in ways which are, in general, the more perfect the higher his culture. The art of cooking, when not allied with a degenerate taste or with gluttony, is one of the criteria of a people's civilization. — König.

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Facts. — Atkinson defines cooking as the art of applying heat to foods in such a way as

(1) To render it digestible, so that its nutrient properties may be assimilated in true proportions in the human system.

(2) To render it appetizing by the development of its own specific flavor.

(3) To combine different kinds of food material in such a way that each will render the other palatable.

(4) To remove certain portions which may not be palatable or digestible after the first application of heat, either as waste, like bone, or as excess, like much of the fat that may be used for other purposes, or as woody fibre in many vegetables.

(5) To add to the essential elements salt in its due proportion in almost every process, and sugar in some combinations, and other condiments, spices, or flavorings in such a way as to develop rather than disguise the true flavor of the principal food material entering into each dish.

In addition to these five results of cooking may be given another and very important one, viz., the destruction of all parasites and bacteria.

The effect of cooking of the starches is to break up the granules, bursting the enclosing sack. Cooking dissolves the connective tissue of meats and fish, thus making the muscle fibres more accessible to the digestive juices. Nevertheless, the cooked proteins, both meat and milk, take a longer time for digestion than the uncooked. A quantity of raw beef that will digest in two hours requires two and a half hours when boiled half done; three hours, boiled well done; three

hours, roasted half done; and four hours roasted well done.

Boiling, steaming, stewing, extracting, roasting, broiling, frying, are the main methods employed in cooking.

Effects of Heat. — To understand the relative merits and best way of using these various methods it is necessary to know the effects of different temperatures upon the food elements. Long continued high temperature together with more or less moisture is necessary for the cooking of all starchy foods. The amount of moisture and length of cooking depends upon whether the result is to be "mealy," or a sweet nutty paste. For a temperature of 320° F. is required to change starch to dextrin, and a still higher temperature to change this product into sugar.

For a fuller exposition of this subject, see the chapter on Starchy Foods, and How to Cook Them.

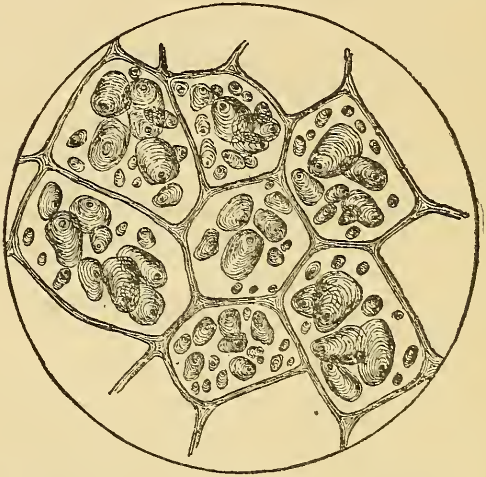
Heat coagulates the proteids. This may be seen in the cooking of milk. The caseine (a proteid) thickens with heat, forms a layer across the top. The white of egg — almost pure albumen — coagulates at about 165° F. Additional heat first brings out the flavor (about 180° F.), and still greater heat makes it hard and indigestible. These statements are approximately true for the protein of meat and fish as well as of eggs.

Obviously, then, a high temperature, desirable in cooking the starches, is undesirable for the proteids.

Effects of Cold Water. — Cold water is an extractive. It "draws out" the flavors of meats and the starch of the starchy vegetables. Therefore the latter should not soak in it, nor should meats be subjected to its influence unless it is desired to extract the soluble elements, to make a broth, or soup, or bouillon.

Method. — To show the effects of cold water on starchy vegetables and something of their composition, use Experiment 5 and the suggested "Home Work" given under

Method in the first part of the chapter on Starchy Foods. Experiments 2, 3, and 4 show the effects of heat on starch. White sauce, its theory and practice, should be taught also. To make this still clearer, show them these illustrations: —



1. Cells of a Raw Potato, with Starch Grains in Natural Condition

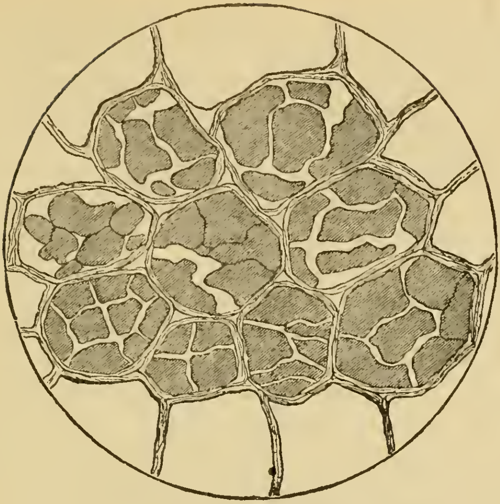
To show the effects of different temperatures on albumen, try the following experiments: —

(1) Put an egg in a cold saucepan, cover it with boiling water, cover, and put it on a board away from the fire for ten minutes. Take the temperature.

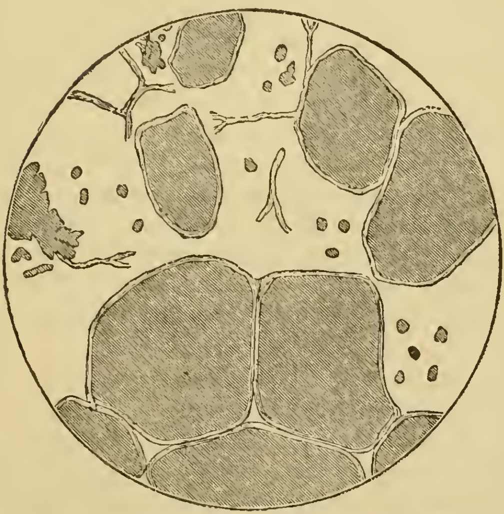
(2) Put an egg in a saucepan in which water is boiling. Cover and put away as in 1. Take temperature.

(3) Put an egg in boiling water and let it boil for ten minutes. The temperature will be of course 212° F.

Notice that in each case the egg has cooked for ten minutes, but at temperatures ranging from about 170°, 185°, to



2. Cells of a Potato boiled in Water One-half Hour



3. Cells of a Potato well steamed and mashed

212°. In the first case the white will be coagulated, the yolk still uncooked, and the whole egg flavorless; in the second, the albumen will be coagulated, but soft, the yolk somewhat thickened, and the whole quite flavory; in the third the white will be hard and indigestible, but the yolk will be mealy and eatable. The difference between the time occupied in the proper cooking of the yolk and the white is due to the fact that the yolk contains a very large amount of oil. The presence of oil or fat renders protein less susceptible to the hardening effects of heat. The egg in experiment two would have been even more satisfactory had it been put in cold water and brought to a boil. The high temperature at first coagulates the outside a little too much. But in no other way was it possible to make the time element the same in all experiments. From these experiments it is evident the best temperature for cooking the proteids is below the boiling point.

To show the effect of cold water on proteid, let each student take two small pieces of beef of equal size. Put one in cold water, and the other in boiling water, kept boiling for several minutes. At the end of half an hour examine both liquids and both pieces of meat. In the first instance the water will be red at the expense of the meat, from which it has extracted much of its juice and soluble food materials. In the second instance the hot water coagulated the protein on the outside. Within it is still red and juicy.

Each student should, if possible, perform all these experiments herself, and must herself think out the deductions. She must also be drilled on the facts, for it is only when they are at the instant command of her mind that she will be able to continue the subject.

Boiling and Steaming. — In boiling the food is surrounded with water at or near the boiling point. Steaming is conducted on the same principle, except that the surrounding and cooking medium is steam instead of water.

The cells of vegetables are for the most part enclosed in walls of cellulose. The older the vegetables the harder and more woody are the walls. From this it follows that the older vegetables will require long boiling to set free the cell contents. Green vegetables are chiefly valuable for the mineral salts that they contain. These unfortunately are somewhat soluble in water. They should, therefore, be cooked no longer than necessary. All vegetables are boiled from the beginning in water at the boiling point.

In general, boiling of vegetables makes them soft and tender, and develops the flavor usually by dissolving out dextrin, which is apt to be present wherever starch is found, or by changing the starch into dextrin.

For further details consult the chapter on Starchy Foods.

Meats and fish are made more tender by boiling; the gelatinoid substances of the connective tissue and of the bones are dissolved out, and flavors are developed.

Meat contains from five to eight per cent of soluble food materials. These include not only the amids, extractives, and gelatinoids, but also some albumen. Remembering, too, that boiled meat takes longer to digest, it seems doubtful wisdom to cook it in this way.

But it is possible to minimize the loss and to utilize the unavoidable waste. This is done by making use of the principle that heat coagulates albumen, and that the higher the temperature the harder will be the product.

For this reason all meats to be boiled are immersed in boiling water and kept boiling for ten minutes. The result of this is that a coat of hard albumen will be formed which will efficiently prevent the further escape of juices. If this treatment were to be continued, the interior of the meat would become hard and indigestible, too. To avoid this, the temperature is allowed to fall to about 180° F.; and with long cooking at this "simmering" temperature the meat within will be tender and juicy.

Since the escape of the juices has been prevented in a measure, the water in which the meat is boiled is not as rich as it would be otherwise; but it is still too good to throw away. It may be used in a nutritious, albeit economical soup, the recipe for which is given under the head of *Boiling* in the chapter on Proteids.

Boiling of Bones. — Long boiling of bones changes their gelatinoids into soluble gelatin. When this is done under high pressure, as in the manufacture of commercial gelatin, then nearly all the cartilage is dissolved. Soft, spongy bones contain the most gelatin. It must not be forgotten that the gelatinoids are excellent fuel foods. It is, therefore, great extravagance not to add bones to the stock pot instead of throwing them away.

Boiling of Milk. — Milk boils at 196° F. For this reason it burns easily and should always be cooked in a double boiler. The object of boiling milk is to kill possible disease germs. Formerly it was "sterilized" by keeping it at boiling temperature for one hour. This did kill the germs, but it also rendered the milk much less digestible. It is now, therefore, customary to pasteurize the milk, particularly if intended for young children. This is subjecting it to a lower temperature for half an hour. An easy and efficient way to pasteurize milk is to immerse it in a tightly covered pail of boiling water; set this on a block of wood, or a wooden table for half an hour, and then chill it with water and put it in the refrigerator. Milk so treated is perfectly digestible and will keep for at least twenty-four hours.

Methods. — Tell the children to boil water at home, watching it carefully from the beginning. Let them bring to you for criticism their written notes on the following points:

(1) Where do bubbles first form?

(2) Where are they largest?

(3) When are they largest?

(4) What happens just before the actual boiling begins?

(5) What is the cause of these bubbles?

(6) At what temperature does the water begin to boil? What is its temperature after ten minutes' boiling? after a half-hour?

(7) Has no more heat been added to the boiling water?

(8) What has become of it?

Of course most children will be unable to determine the questions of temperature at home. This work, then, must be performed in the schoolroom.

Get from the children the fact that the two important sources of foods are plants and animals. Let them classify each. Probably the plants will be subdivided into cereals, roots and tubers, green vegetables, fruits; and animal food into milk, eggs, meat, poultry, fish. Consider the approximate composition of each, the effect of heat upon it, and the consequent method and time of boiling.

Stewing. — The object of stewing is to cook the meat so that it will be tender and juicy, and to serve with it the broth in which it has been cooked, which shall also be rich and appetizing. Obviously, to put the meat into boiling water will keep the broth from receiving its quota of flavor and food, and, at the same time, to let it stand in cold water will enrich the broth at too great an expense to the meat.

The usual method is to cut the meat into small pieces, thus exposing a large amount of surface to the cold water, into which it is then placed. Then raise the temperature to the simmering point (180° F.) and let it cook for several hours.

Allowing the water to boil will be fatal to the success of the stew, for at that temperature, the albuminoids of the meat exposed to the action of the heat, because of the great amount of surface, will become hardened and dry. The meat may *look* tender, for the long boiling will dissolve the

connective tissue and set the muscle fibres free, only to expose them more effectively to the searing action of the high temperature, thus rendering them very hard and dry.

Extracting. — It must be obvious from the above, that when the object is to extract from meat its juices, that the proper method to be pursued is to cut it into small pieces, exposing it for half an hour to the action of cold water. It should then be covered, put on the stove, and gradually brought to the simmering point. Let it simmer for five or six hours. The brown scum that accumulates on the surface is coagulated albumen, and thrown away only by the ignorant.

The meat which is left has lost its extractives (useful chiefly for flavor), its salts, and its water, and a small part of its fats and albuminoids. It will not sustain life if used as an exclusive diet, but at the same time it is great extravagance to throw it away. The chief objection to it is that it is not palatable. To make it so, and also to restore to it part of its lost nutritive value, salt it, and use it for meat cakes or croquettes.

Roasting. — In roasting, as in boiling, the object is to sear the surface of the meat by subjecting it suddenly to intense heat, and then to cook it thoroughly by long exposure to a much lower temperature. This is done by putting it into a hot oven for about a half-hour. Then, when the outside is browned, close all drafts, opening the checks, if necessary, to lower the temperature for the slow cooking that will develop its flavors.

Potatoes, containing as they do so much moisture, may be roasted. Some means of escape must be provided for the steam. This is usually accomplished by piercing them with a fork, when they are half done.

Broiling. — Broiling depends on the same principles as roasting, but the cooking is done over coals instead of in the oven.

Frying. — Frying, too, depends upon the same principles, but the searing medium here is hot fat. The hotter the fat, the more efficiently will it sear the meat. Therefore, olive oil, which does not burn until it reaches a temperature of 608° F., is the best material to use. Cotton-seed oil, lard, drippings, suet, butter (to give them in the order of their burning temperatures), are the next best frying media.

Doughnuts and batters generally need a lower temperature than breaded meats. These in turn do not require as high a temperature as potatoes. Fish and all watery articles must be fried at the highest possible temperature.

The rule for all is that the fat should be "smoking hot." "Smoking hot," however, may be divided into three classes: 1st, when a faint blue smoke rises from the centre; 2d, a stronger smoke; and 3d, a still stronger smoke. The last is of course the hottest, and the fat must be in this condition before it can be used for fish.

Why does fish require a higher temperature? Because it contains much water, which will lower the temperature. Water in the fat means that the temperature will be so lowered that it is no longer capable of searing the food, and for these reasons penetrates into the interior and soaks it with grease. Therefore, in frying any wet food, watch the fat carefully. When it has bubbles of steam, let every drop of water evaporate by keeping it hot.

A draft of air cooling the surface of the article to be fried will also cause it to absorb the grease. This is the reason why it is important to fry only in deep fat.

The kettle of fat needs particular care. As has been already indicated, water must be evaporated from it before it is used for frying. Consequently, if it gets too hot, it may be cooled by throwing into it a handful of raw sliced potatoes.

After use it should be at once set in a cooler place, and, when quite cool, but still liquid, strained.

Method. — Treat these processes of cooking in the way suggested for boiling.

It is most important that, if possible, the experiments shall be individual work. At any rate the facts deduced from such experiment must be reasoned out by each pupil. An excellent device is first to review the experiment so as to be sure that all essential details are familiar to them, then to ask suggestive questions developing the theory involved, allowing each student to write her answer. The papers may be changed, and each, over her own signature, may criticise the answer of another. Collect the papers. For your own advantage look over some at least of the answers originally given up. Sometimes it is a good plan to let the children write an answer after you have taught the lesson.

Do not forget that in this, as in all other subjects, *drill* is absolutely necessary.

CHAPTER VIII

FISH, OYSTERS, AND SALADS

By ALICE HOOPER BECKLER, B.S.

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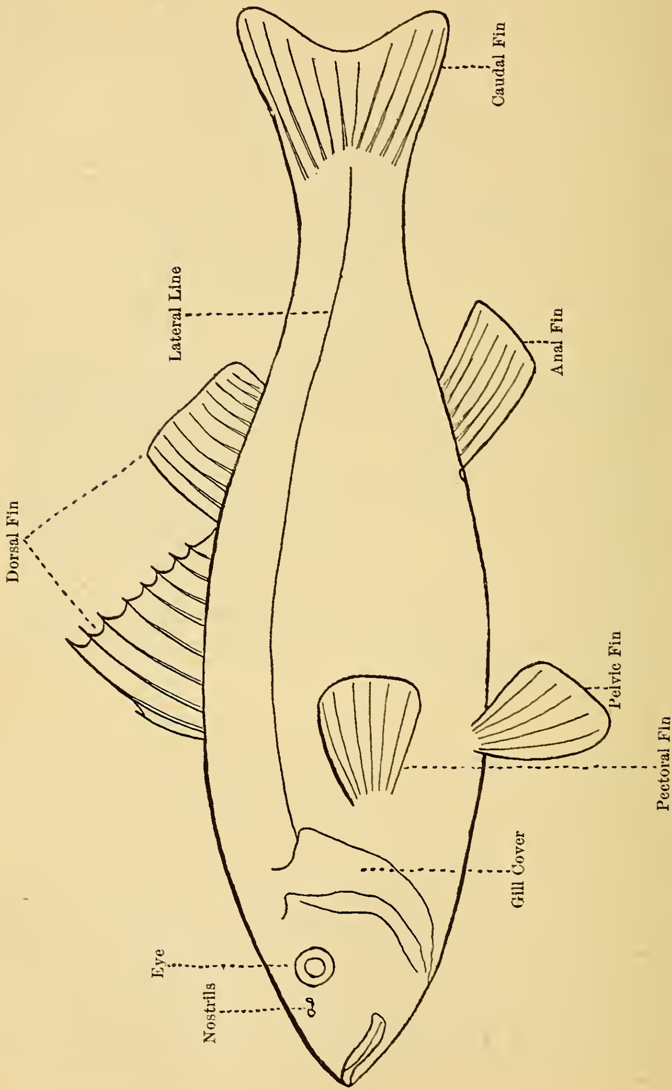
FISH

The term *fish,* when used to express the article of diet, generally includes, besides the backboned forms, mollusks and crustaceans. Here, however, it refers only to the lowest group of the vertebrates.

External Anatomy. — *Shape of Body.* The flat body, tapering at both ends and covered with scales, is well adapted for rapid movement though the water. This is accomplished in the same manner as in sculling a boat, the oar in this case being the tail of the fish, which is drawn to the side and then forcibly straightened, thus sending the fish forward.


Caudal Fin
Lateral Line
Anal Fin
Dorsal Fin
Pelvic Fin
Pectoral Fin
Gill Cover
Eye
Nostrils

Fins. — These are folds of the skin supported by long processes or spines. Like most vertebrates, the fish also has two pairs of appendages, the *paired fins*, the anterior known as the pectoral, or arm fins; the posterior, the pelvic, ventral, or leg fins. The latter vary in position, situated sometimes near the pectoral, sometimes nearer the anal.

Head. — The posterior boundary of the head is marked by the gill cover, under which we find the gills.

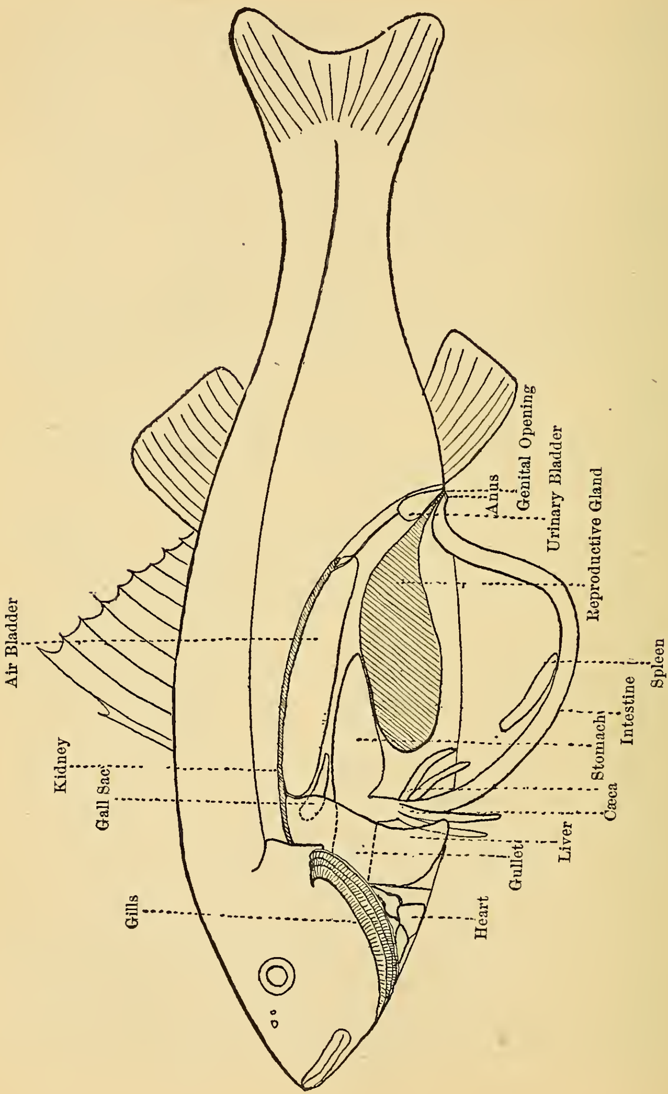
Sense Organs. — Eyes and nostrils appear on the head. The ears have no external openings. Another sense organ of doubtful function is the lateral line which extends thoughout the entire length of the fish from the gill cover on each side.

Protective Covering. — The scales, attached at the forward end and overlapping those behind, lie beneath a thin skin which often contains pigment.

Internal Anatomy. — The drawing on page 176 explains the position of the internal organs in the perch. These lie in a cavity bounded dorsally by the backbone, posteriorly by the anal fin, and anteriorly by the head.

Edible Portion. — Along the entire length of the backbone, on each side, from the head to the tail-fin, are to be found larger strips of muscle divided into sections or "flakes." This muscle is generally white in color, such fish as salmon, herring, mackerel, and sturgeon being exceptions. The muscle fibres are larger in the fish than in any of the other vertebrates, and have less connective tissue holding them together. On this account the flesh of the fish is not only quickly cooked but easily broken during the process.

Development. — The sexes are as a rule separate. The ovaries when ripe constitute the "roes," the corresponding organs in the male giving rise to the "milt." The eggs are laid in the sand or attached to rocks or to water plants by the female, the male subsequently passing over them the


Air Bladder
Kidney
Gall Sac
Gills
Anus
Genital Opening
Urinary Bladder
Reproductive Gland
Spleen
Intestine
Stomach
Cæca
Liver
Gullet
Heart

milt which fertilizes them. Many eggs are laid, but many are devoured long before they are large enough to escape from the other fish which feed upon them. The length of time taken in development is very short, thereby insuring greater safety. The United States Fish Commission, by artificially propagating the young fish, and then stocking ponds, streams, and bays, protects many fish from utter annihilation.

The eggs and milt are taken from the mature fish, mixed, and then placed in jars of water which reproduce as far as possible natural conditions. Here, in the various hatcheries belonging to the government, the young fish live until large enough to be taken with safety to their own natural environment. "The product of the shad fishery is to-day as much a subject of artificial control as the corn crops," said the late Hon. Marshall McDonald, the United States Commissioner of Fish and Fisheries. This statement would apply equally to the cod of the New England coast, the salmon of the Pacific, and the whitefish of the Great Lakes. All of these fisheries are preserved to-day by the labors of the Fish Commission.

Preparation for the Market. — As an important article of food, the value of fish cannot be overestimated. It enters into the diet of nearly every American family. Generally speaking, fish taken from cold, clear, deep water, with a sandy or rocky bottom, are preferable to those taken from warm, muddy, shallow water. Thus, most of our important fisheries are in our northern Atlantic and Pacific states, and in those bordering on the great lakes. Fish should be killed at once after taking from the water, as, otherwise, the flesh becomes soft and does not bear shipment so well. The ordinary method for transportation is packing in ice. Sometimes the organs are removed, or in other words, the fish is "dressed" before packing. More frequently, however, it is

N

packed "whole." Fishermen, as a rule, do not use proper care in handling the fish, so that, when offered for sale in the city markets, it is anything but attractive. The outer skin, from rough handling becoming injured, very soon gives rise at those points to decay, which rapidly spreads throughout the fish.

Then, too, the internal organs probably begin to decompose very shortly after death, and should therefore be removed before shipment. Bleeding the fish after capture would also prevent rapid decay. Direct contact with the ice is not the best method of transportation. When the proper precautions are taken in shipping, this important article of food will become more attractive, and will then assume a larger and more important place in our diet than at the present time.

Large quantities of fish are preserved by drying, salting, smoking, and canning.

Seasonableness. — Most fish are not seasonable at the time of spawning, the flesh at this time being less firm, the nutrition going mainly to the reproductive organs. Some fish, the shad for example, are preferred at this time. Herring, too, is captured usually at this season, since at other times it is very difficult to take.

The following list was obtained from a Philadelphia dealer, and represents the fish purchased by him during each month of the year.

January

Cod; Haddock; Hake; Black Bass; White Perch; White Catfish; Red Catfish; Spotted Trout; Ciscoes; Spotted Drum; Nova Scotia Herring; Smelts; Spanish Mackerel; Rockfish; Halibut; Sunfish; Salmon; Eels; Green Pike; Blue Pike; Gray Pike.

February

Cod; Hake; Haddock; Halibut; Spotted Trout; White Perch; Nova Scotia Herring; Ciscoes; Smelts; Crokers; Shad; White Catfish; Red Catfish; Rockfish; Black Bass; Eels; Green Pike; Blue Pike; Gray Pike; Salmon; Flounders.

March

Cod; Hake; Haddock; Halibut; Ciscoes; Smelts; White Perch; Rockfish; Nova Scotia Herring; Shad; Spotted Trout; Salmon; Crokers; Black Bass; Eels; Flounders; White Catfish; Red Catfish; Green Pike.

April

Cod; Hake; Haddock; Halibut; Shad; White Perch; Yellow Perch; Rockfish; Eels; White and Red Catfish; Flounders; Salmon; Crokers; Bluefish; Weakfish; Delaware Herring; Sheephead; Cape May Goodies; Sturgeon; Porgy; Butterfish.

May

Shad; Delaware Herring: Hake; Cod; Haddock; Rockfish; White Perch; Yellow Perch; Bluefish; Weakfish; Sturgeon; Porgie; Flounders; Red Drum; Black Drum; Crokers; Cape May Goodies; Sheephead; Eels; Red and White Catfish; Halibut; Salmon; Spanish Mackerel; Butterfish.

June

Same as May, with addition of Sea Bass; Kingfish; Blackfish.

July

Same as June, but no Shad or Delaware Herring.

August

Same as July, but no Sturgeon.

September

Same as August, with addition of Ciscoes; Round Mackerel; Whitefish.

October

Same as September.

November

Same as October, but no Porgies, Blackfish, or Kingfish.

December

Same as November, but no Black Drum, Red Drum, Butterfish, or Cape May Goodies; with addition of Blue Pike; Spotted Drum.

Kinds of Fish. — If Chart I be examined, it will be seen that the amount of oil contained in the flesh of the fish varies, thus giving rise to two classes, the *dry* or white fish, like the cod, haddock, and bluefish, and the *oily* fish, salmon, mackerel, and shad. It is the oil which imparts to these fish their characteristic flavor. Halibut falls between the two classes.

The dry fishes, owing to lack of flavor, require, in cooking, seasoning and rich sauces.

Nutritive Value of Fish. — In Chart II fish is compared with other common foods, as regards amount of nutrients. Like beef and mutton, it will be seen that fish is rich in the nitrogenous principle, proteid, and should hold the same place in our diet as these; that is, it should be accompanied by foods rich in carbohydrates, as potatoes, bread, and the like, and served with a thickened sauce. Fish is, also, stuffed, thus adding the carbohydrate element.

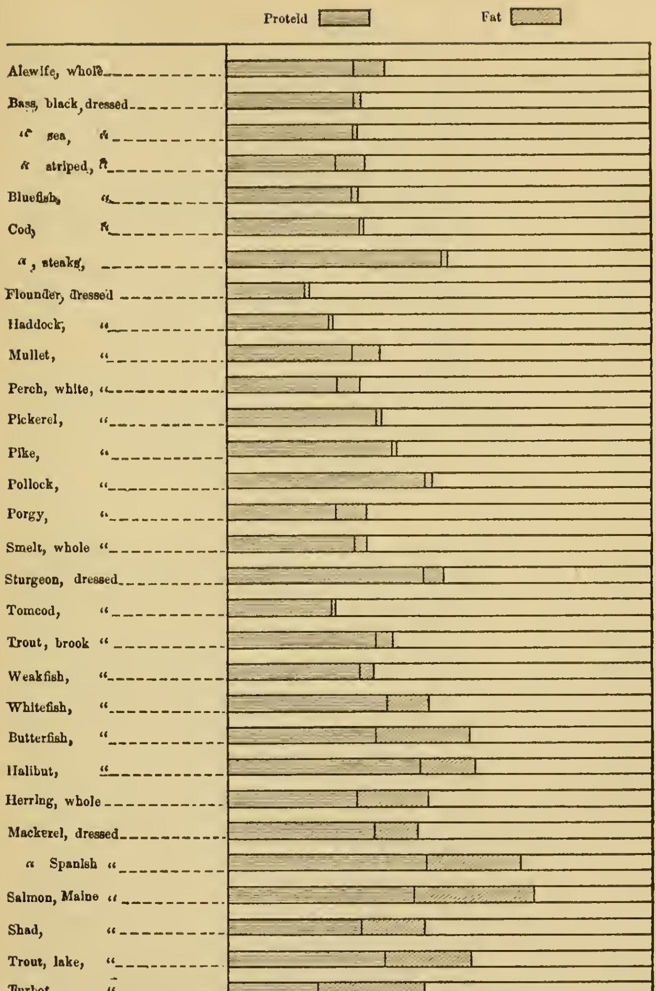


CHART I. — SHOWING RELATIVE FOOD VALUE OF DIFFERENT VARIETIES OF FISH

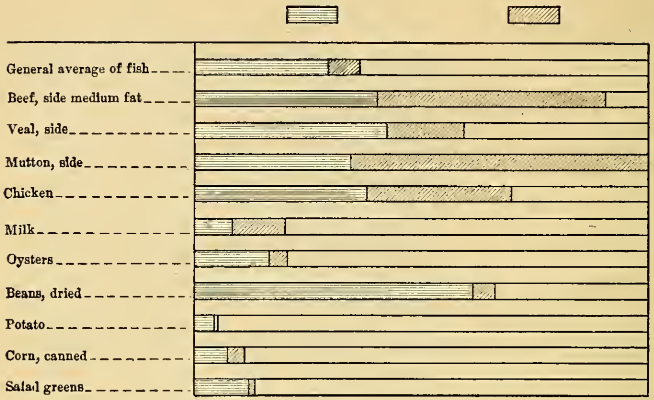


CHART II. — SHOWING RELATIVE FOOD VALUE OF FISH AND OTHER FOODS

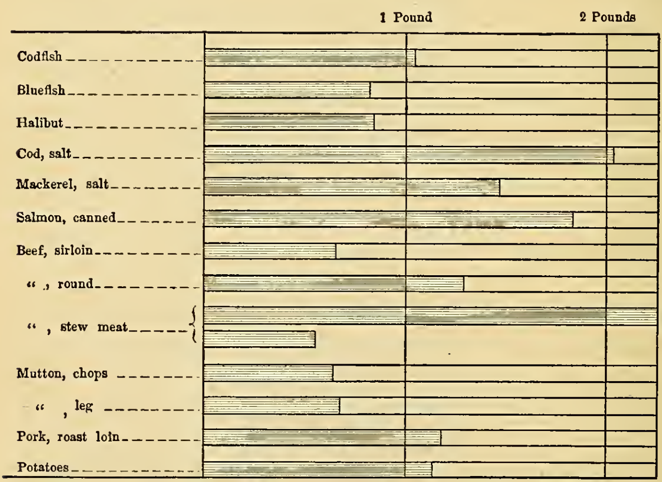


CHART III. — SHOWING AMOUNTS OF PROTEID TO BE OBTAINED FOR ONE DOLLAR, IN DIFFERENT FORMS OF FOOD

From the side of economy, fish also holds its own. Chart III shows the amount of proteid which one dollar will buy in various forms of food. It will be seen that fresh fish falls between the expensive and the cheaper meats, the salted and canned fish approaching more nearly the latter.

NOTE. — The teacher is strongly recommended to copy and enlarge these charts, that the pupils may discover these points for themselves.

Digestibility of Fish. — The question of digestibility is always important in estimating the food value of any article. An analysis may show that a food is rich in proteid, and yet, if a considerable portion of that proteid pass through the alimentary canal undigested, its value is very much impaired. As far as can be ascertained, fish and lean meat seem to be about equally digestible. Just as leaner meats are more easily digested than the fatter kinds, probably the white or dry fishes are more easily digested than the oily, as shad, mackerel, and salmon.

Dangers from eating Fish. — Probably these are no greater than for meat. Like meat, the flesh of the fish may contain parasites; and if not perfectly fresh, it may, like meat, contain the resulting compounds of bacterial decomposition, the ptomaines. If thoroughly cooked, the danger from parasites is eliminated; and if only fresh fish is used, the danger from bacterial poisoning disappears. To insure the latter condition, great care should be used in preparing fish for the market, and it should be eaten as soon after capture as possible. Canned fish should always be used at once after opening.

Selection of Fish at the Market. — A fresh fish always has the eyes clear, the scales brilliant, the gills a vivid red color, and the body stiff, leaving no mark when pressed by the finger.

To scale the Fish. — After rinsing in cold salted water,

lay the fish on the side, firmly grasp the tail, and with a sharp knife remove the scales by scraping from the tail towards the head. Rinse the knife frequently in cold water to remove the scales.

Cleaning the Fish.—This should be done as soon as possible. Rest it on the back and cut on the ventral side from the anus forward to a point between the gills. This exposes the whole body cavity, containing the internal organs. Remove all of these, taking great care not to break the gall sac (see drawing). The kidneys lying directly under the backbone must be scraped away. Wash quickly, not allowing it to soak, wipe out with a clean towel, and if not to be used at once, sprinkle a little salt on, and put away in a cool place.

Methods of Cooking.—The rules for the cooking of meat apply here for the fish. During the process of cooking, fish, while retaining probably most of its oil and proteid, loses a large amount of water, thus becoming much drier. For this reason a sauce generally accompanies the fish when served.

Boiling.—(See chapter on Methods of Cooking.) Salt and an acid, such as vinegar or lemon, coagulate albumen, and are therefore frequently added to the water. Besides this, salt also raises the temperature of the water slightly. Since the fish is so easily broken, the water should never actively boil after the fish has been added to it.

To boil Cod.—For boiling, the head and tail should be removed. Wash the fish and remove the black skin by placing in a pan of boiling water for two or three minutes. The skin can then be scraped off. Place the fish on a lifter or wrap it in a piece of cheese cloth. Put it in the kettle with enough boiling water to cover it, to which has been added 1 tablespoon of salt, 1 tablespoon of vinegar or lemon juice, 3 cloves, 3 peppercorns, 1 bay leaf, 1 small onion and

carrot sliced. Simmer, allowing ten minutes to the pound. Before serving let the fish remain five minutes in the water to "improve," that is to absorb more of the seasoning.

To serve the Fish. — Arrange a napkin on the platter and place the fish upon it. Garnish with hard boiled eggs, or lemon, and parsley. Serve with boiled fish either egg or Hollandaise sauce.

Egg Sauce. — $\frac{1}{4}$ cup butter, 1 tablespoon flour, $\frac{1}{3}$ teaspoon salt, $\frac{1}{2}$ pint boiling water, 3 hard boiled eggs. Mix the butter, flour, and salt, add the water, boil up once and remove from the fire. Add the eggs chopped.

To fry Small Fish. — The head and tail are not removed in small fish. Dry the fish thoroughly, dust with salt and pepper, and roll in flour or crumbs, then in egg, and in crumbs again. Drop them into deep hot fat, or place first in frying basket, and then lower into the fat. The length of time needed to cook thoroughly depends upon the size of the fish. Smelts take about four minutes, larger fish a longer time.

To serve Fried Fish. — Allow all the fat to drain from the fish, then serve, garnishing with slices of lemon and parsley.

Baking. — In baking, the fish is cooked in its own juices, the heating medium being mainly hot air. In this method of cooking considerable evaporation of the juices takes place from the outer surface. To prevent the fish from becoming too dry, therefore, it has to be frequently "basted" with the juices coming from it, and with the fat which has been added. By thus forming a coating of fat over the surface more of the juices are retained. The high temperature of the oven causes a certain amount of browning, as in frying, which adds greatly to the flavor.

In baked fish probably a large amount of water is driven off, thus concentrating somewhat the extractives, thereby

imparting a stronger flavor than in boiled, or even fried fish. Dry fishes need the addition of fat in baking.

To bake Cod. — This rule applies equally to haddock, bluefish, bass, or shad. Allow fifteen minutes to a pound. Rub the fish with salt and pepper, stuff it, and sew it up.

Stuffing. — 1 cup bread crumbs, 3 tablespoons butter, $\frac{1}{4}$ teaspoon salt, $\frac{1}{4}$ teaspoon pepper, 1 teaspoon chopped onion, 1 teaspoon chopped pickles, 1 teaspoon chopped parsley. Melt the butter, and stir in the other ingredients. This is enough for a four-pound cod.

The head and tail should not be removed, but should be wrapped in greased paper to retain their shape so far as possible. Brush the fish over with lemon juice. Cut gashes across the fish on each side about three inches apart, into which insert strips of salt pork. Grease a fish sheet with a piece of pork, place the fish on it, and put into an uncovered roasting pan, with the pork around it. Bake quickly, basting every ten minutes with the fat in the pan, not omitting the paper covering the head and tail.

To serve the Baked Fish. — Garnish with plenty of parsley or watercress, in order to partially conceal the head and tail. Use also slices of lemon. The sauce may be poured around the fish or served separately.

Brown Sauce. — 1 cup hot beef stock, or 1 cup boiling water, and $\frac{1}{3}$ teaspoon beef extract dissolved in it. 2 tablespoons melted butter, 1 heaping tablespoon flour, $\frac{1}{4}$ teaspoon salt, 1 slice onion. Melt the butter, and brown the slice of onion in it. Remove onion, and let the butter become well browned. Then add to it the flour and gradually the bouillon. Stir and cook a few minutes; add the salt and a dash of pepper.

To broil Fish. — Small fish are broiled whole; cod, haddock, if large, as well as halibut and salmon, are best cut in slices. Medium sized fishes, as shad, bluefish, mackerel, and

trout, should be split down the back and have head and tail removed. Heat the broiler, and grease. Flour or butter the fish to prevent sticking.

Broiled Cod. — Take slices about one inch thick, season with salt and pepper, and dredge with flour. Broil twelve minutes. Serve with butter sauce and garnish with parsley.

Butter Sauce. — $\frac{1}{2}$ cup butter, juice $\frac{1}{2}$ lemon, $\frac{1}{2}$ tablespoon chopped parsley, 1 saltspoon salt, pepper. Cream the butter until foamy and light, add lemon juice, parsley, salt, and pepper. Spread over fish as soon as it is broiled.

SYNOPSIS OF LESSONS

(Two hours each)

First Lesson

1. Selection of fish at the market.
2. Anatomy: external and internal, edible and non-edible portions, structure and composition of edible portion.
3. Clean the fish.
4. Boil the fish.
5. Method of serving.
6. Sauce.

If possible at this time, take the fish as the subject of nature lessons, using the fish in the schoolroom aquaria. The explanation of the subjects here indicated is given under essentially the same headings in the preceding pages of this chapter. Use cod or haddock, the size depending upon the size of the class. After cleaning the fish, cut into small pieces, giving each pupil three pieces.

Questions and Directions for Pupils. — Examine the piece of uncooked fish. How does the flesh of fish resemble that of beef or mutton?

How does it differ from it?

Have three small stewpans, one containing cold water; a second, water at the point of boiling; a third, water at the boiling point, to which has been added a half teaspoonful of salt, a half teaspoonful vinegar, one clove, one peppercorn, a half bay leaf, a slice of onion and carrot.

Into each stewpan place at the same time a piece of fish. Allow the one in cold water to come to the boiling point, keeping it at that temperature about eight minutes. Keep the other two at the boiling point, but not actively boiling, for about eight minutes also.

What differences did you observe in the three pieces as they were immersed?

What caused these differences?

What appeared on the water in the first stewpan? What was the cause of this?

Why was the vinegar and salt added to the third?

Why was the clove, peppercorn, etc.

Taste each piece, and decide which is the best method to use in boiling a fish.

Why should the water not boil vigorously?

Why is a fish wrapped in cloth when boiled?

Dictate to the class the rule for boiling a fish; also the sauce to serve with it, and method of serving. Let each child then make the sauce according to the following individual rule.

Egg Sauce (Individual).—1 tablespoon butter, $\frac{1}{2}$ tablespoon flour, $\frac{1}{4}$ teaspoon salt, 1 gill boiling water, $\frac{1}{2}$ hard boiled egg. Mix butter and flour together, add water gradually, stirring all the time. When it thickens, take from the fire and add the egg chopped fine.

Second Lesson

1. Nutritive value of different kinds of fish (Chart I).
2. Dry and oily fish (Chart I).

3. Frying fish.
4. Uses of left-over fish: cream fish.

The chart, copied and enlarged, should be hung on the wall where the pupils can all see it clearly. After explaining which tint or color stands for proteid, and which for fat, let them discover the two kinds of fish, dry and oily, having, if possible, the two kinds to show to them. Canned salmon will serve for the oily fish. Discuss the differences in flavor in the two varieties.

Let each child then prepare a small fish, smelt or perch, for frying. This will review the last lesson on cleaning, and give each child an opportunity to put into practice that which was before demonstrated by the teacher. Point out the differences between frying and so-called frying, or sautéing.

Questions to Suggest. — Why should a deep kettle be used in frying?

How do you know when the fat is sufficiently heated for frying the fish?

What difference do you observe between immersing in hot fat and in hot water?

What is the cause of the spluttering when the fish is immersed?

How does the fish change in appearance? Why?

What is "browning"?

Why was no crust formed on the boiled fish?

Note the difference in taste between the boiled and fried fish.

Uses of Left-over Fish. — The teacher may use any rule here that she may prefer. The following recipe is given in both the large and the individual rule, and is recommended for cold boiled fish.

Fish à la Crême. — 1 tablespoon butter, 1 tablespoon flour,

1 cup hot milk, in which $\frac{1}{4}$ bay leaf and 1 slice onion have been simmering, $\frac{1}{4}$ teaspoon salt, pepper, yolk of 1 egg, $1\frac{1}{2}$ cups cold flaked fish.

Melt butter till it bubbles. Stir in the flour, and add the milk gradually. Stir until perfectly smooth; add a few grains pepper and the salt. Remove from the fire, and add the beaten yolk of an egg, to which a tablespoon of cold milk has been added to prevent coagulation. Pour this sauce over the cold flaked fish; put into a baking dish, sprinkle with a little salt and pepper, and cover with bread crumbs. Bake in a hot oven until brown.

Individual Rule. — $\frac{1}{2}$ teaspoon butter, $\frac{1}{2}$ teaspoon flour, $\frac{1}{4}$ cup hot milk, $\frac{1}{8}$ bay leaf, $\frac{1}{4}$ slice onion, $\frac{1}{4}$ yolk of an egg, $\frac{1}{4}$ cup cold flaked fish, pepper and salt.

Put the piece of bay leaf and onion in the cold milk, and let it remain until the milk is hot. Bake in scallop shells.

Third Lesson

1. Digestibility of fish.
2. Value of fish as food. Compare with other foods (Charts II and III).
3. Necessity for seasoning most fish.
4. Baking fish.
5. Stuffing.
6. Sauce.

Let each child again make use of a small fish, smelt or perch. The object in this lesson is to give each one an opportunity to learn the technique by doing the work for herself from the beginning. Small fish accomplish this end as well as large, and, at the same time, reduce the expense. The individual rule for stuffing may be more than enough for a very small fish like a smelt.

After stuffing the fish, sew it, and follow the same di-

rections as used in the large fish, care being taken in slashing to have the gashes on opposite sides alternate. All the fish may then be baked together in a large baking pan, each student's name being attached to her fish. Some extra strips of pork must be placed in the pan.

While the fish is baking, let each one make the sauce, and prepare the lemon and parsley for garnishing, not omitting, however, the basting of the fish.

Questions. — How is the heat applied in baking?

How does this differ from frying? From boiling?

In baking the fish, why is it necessary to continually baste it?

Why is the pork used?

What is gained by stuffing the fish?

Brown Sauce. — (For individual rule see *Sauces* in chapter on Starchy Foods.)

Fourth Lesson

1. Propagation of fish. Work of United States Fish Commission. (See *Development.*)
2. Season of fish. (List of months.)
3. Dangers from eating fish.
4. Broiling fish.
5. Sauce.
6. Serving.

In this lesson either let each pupil broil a slice of cod, and also a smelt, or let half the class use one fish, the other half the second. The directions for broiling cod have already been given.

To Broil a Smelt. — This is used to show the method used in medium sized and small fishes. Split the smelt down the back and remove the backbone. Place upon a hot greased broiler, and broil over hot coals a very few minutes.

Questions. — What is "broiling"?

Why is it necessary to have the coals glowing?

Why should a crust be formed quickly on both sides?

What causes the puffy appearance of the fish?

Butter Sauce (Individual Rule). — 1 tablespoon butter, $\frac{1}{2}$ teaspoon lemon juice, $\frac{1}{4}$ teaspoon chopped parsley, $\frac{1}{4}$ saltspoon salt, pepper.

Rub and beat butter until light and foamy. Add lemon juice and parsley, salt, and a few grains pepper. Spread on the fish when it comes from the broiler.

OYSTERS

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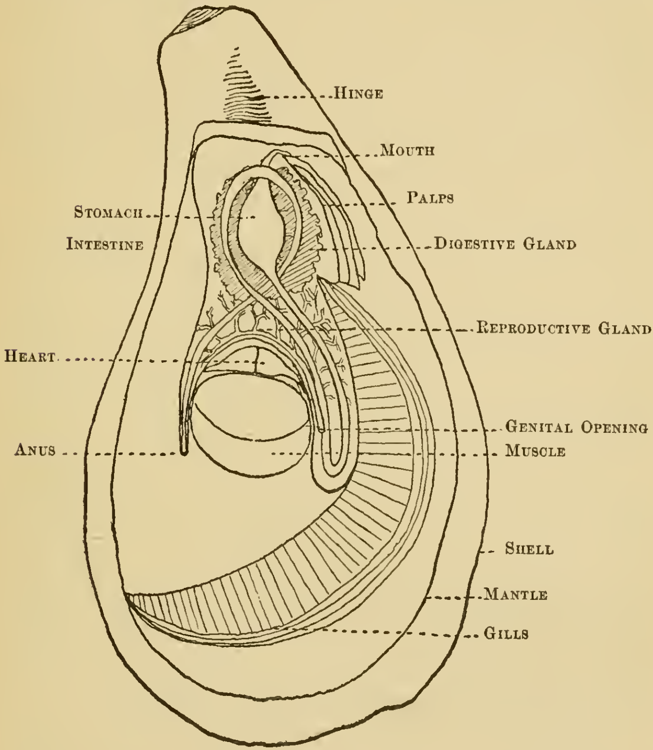
We have only to look at those massive heaps of shells left here and there along our shores or river banks to realize that man's fondness for the oyster is very ancient. Wherever the mollusk flourished the débris from the feasts tells of the enormous number consumed. Of all mollusks the oyster is the favorite. When the settlers reached these shores the oyster industry was very active, the Indians near the shore catching them and selling them to those living farther inland.

As the inhabitants increased, and towns sprang up, the oysters began to diminish in number until many beds were completely destroyed. The increasing scarcity finally led oystermen to increase the area of the natural beds, or to plant new ones, and place the young oysters upon them.

Anatomy of Oyster. — The oyster, together with the clam, mussel, and scallop, belongs to the group of invertebrate animals, mollusca, which means soft bodies. The oyster has no distinct head, nor even a foot for digging, as



has the clam. Its soft body is enclosed by a fold of membrane known as the mantle, which secretes a shell made up of two valves. These valves are held together by a very strong muscle, the position of which is shown in the large

blue spot, frequently called the eye, on the inside of each shell.

Since the oyster always remains attached after its larval life, it has no organs for locomotion; and since it always rests upon one valve, that valve becomes deeper than the upper one, which then acts as a cover. This cover is left open, that the water may pass over the gills and also to the mouth, situated near the hinge, where four palps carry the food into the opening, and thus into the alimentary canal. When danger threatens, the cover is instantly closed. Even this, however, is not proof against the oyster's enemies. Chief among these is perhaps the starfish.

Planted Beds. — In the natural beds there is always a great deal of crowding. Many oysters die because with the growth of those next to them it becomes impossible for them to open the shell. By spreading oyster shells near the natural bed, the area of the latter is increased. The "spat" attaching themselves to these shells prevent crowding on the old bed, and very much increase the yield.

"Seed" oysters are young oysters varying in size from one to one and one-half inches in length. The raising of "seed" oysters is known as "farming." The chief source of the seed on our coast is the Chesapeake and the Connecticut shore, the latter sending large quantities to Europe.

The seed is planted mainly along the whole New England coast, Long Island Sound, New York Bay, and Delaware Bay. It is now being extended farther south, and even along our southern shores in the Gulf of Mexico.

Preparation for the Market. — It is customary to eschew oysters during the months which possess no "r" in their name, since during these months the eggs are developing and being discharged. The sexes are separate in the oyster of our eastern coast. The reproductive glands, when filled with the ripe generative cells, stand out on each side of

the body as large white masses. Dr. Brooks has estimated that a medium sized Maryland oyster will discharge annually sixteen million eggs.

Many oystermen transplant the oysters from muddy to gravelly beds for a few months, in order to rid the intestine of all mud taken in with the food. Then, too, just before bringing to market the oysters are placed in brackish water to "fatten," since a higher price can be obtained generally for oysters thus treated. By this process the oysters gain in weight probably by absorption of water into the tissues, but lose a small amount of nutrients.

Sometimes oysters acquire a green coloration, due to certain vegetable organisms upon which they have fed, the green color being especially noticeable in the gills. This does not in any way injure the oyster, which as a rule is plump and round from the abundance of food. In Europe the green oysters are very much prized.

Owing to the close fit of the edges of the shells, oysters will live a long time out of water, and in this condition may be transported long distances in barrels or sacks.

The size of the oyster depends to a great extent upon its age. Most small oysters receive the name "Blue Points," although very few of them probably are from Long Island.

Nutritive Value. — From the chart it will be seen that oysters contain about the same amount of nutrition as an equal amount of milk, that is one quart of oysters would about equal one quart of milk. As an article of food they are expensive, and must be regarded as a luxury. Uncooked and with the gills removed they are easily digested.

Preparation for Cooking. — Pour half a cup of cold water over one quart of oysters, and with clean hands take them out separately, removing any *bits of shell* or seaweed. The small crabs, frequently found with the oysters, are very delicate morsels, and should be cooked with the oysters.

The oyster liquor is seldom used, since so much comes from the oysters while cooking. If it is desired, however, it should be strained before using.

Oyster Soup. — 1 quart oysters, 1 pint milk, 1 tablespoon butter, 2 tablespoons flour, salt to taste, ½ saltspoon pepper, two pieces celery.

Heat the milk and celery in a double boiler while you prepare the oysters. (Directions already given.) Strain the oyster liquor through the finest strainer. Put on to boil. Remove the scum, and when clear add the oysters. Let them simmer until they begin to grow plump and the edges curl or separate. Strain the liquor into the milk, put the oysters where they will keep hot but not cook. Melt the butter, stir in the flour while bubbling, and add the milk gradually. Boil three or four minutes. Remove from the fire, add the oysters, and serve very hot.

Oyster Stew is made like oyster soup without the thickening.

Creamed Oysters are made in very much the same way. A cream sauce is first made, and the oysters, after parboiling, are added to it. These may be served on toast or in pattie shells.

Lesson

1. Anatomy of the Oyster.
2. Food of Oyster.
3. Enemies of the Oyster.
4. Oyster Beds — Natural and Planted.
5. Preparation for the Market. Position of Most Extensive Beds.
6. Nutritive Value.
7. Preparation for Cooking.
8. Oyster Soup. Oyster Stew. Creamed Oysters.

Method. — Let each pupil have an oyster, from which the flat (right) valve has been removed, so that it rests on the deep (left) valve. Place a drawing of the anatomy upon the board and go over it with the specimens before them. If other mollusks have been taken, compare. Take, then, the subjects indicated in the above outline. Use the individual rules given below.

Oyster Soup (Individual Rule). — 3 oysters, ½ cup milk, 2 tablespoons oyster liquor, 1 level teaspoon flour, 1 teaspoon butter (slightly rounded), 1 saltspoon salt, speck of white pepper, 2 inch piece of celery.

SALADS

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Food Value of Salad. — No dinner is complete without a salad, and only on the score of lack of time should it be omitted. The number of possible salads is legion. A salad, as a rule, has three good qualities: it is healthful, it may be economical, and also very attractive. It is healthful in that it adds to our diet the fresh, green, uncooked vegetables, and a mild acid, both of which are especially beneficial. In cooking vegetables, much mineral matter is lost which is of course retained in the uncooked greens of the salad.

Economy. — It is economical, since in a salad we may make use of left-over portions. There is scarcely any meat or vegetable left from dinner that cannot be used in this way.

It is hard to realize what a close connection exists between the eye and the digestive organs, but an attractive, well-served dish adds very materially to one's appetite and

to one's digestive powers. A well-made salad is the most attractive part of the dinner.

Greens used for Salads. — In plants, the cell wall is a much harder, firmer substance than that of animal tissue. It is known as cellulose, and is, chemically, closely related to starch, belonging to the class of compounds, carbohydrates. This cellulose differs markedly in its physical characteristics. Thus in the potato it is loose and spongy, in celery much tougher and elastic, in wood it becomes very compact, and in the shells of nuts extremely hard. Cooking softens this cellulose wall.

Since age increases the amount and the toughness of the cellulose wall, only young plants should be used in salads. The list of plants used is a large one. Most of them have been known and cultivated for this purpose for centuries, originating probably in the Eastern countries. We read of them in Greek and Roman writings, serving the same purpose as at the present day.

Cultivated herbs, lettuces, escarole, chicory, endive, celery, nasturtium, and wild greens, watercress, dandelion, daisy, mustard, and peppergrass, constitute the plants most used at the present day.

Variety of Salads. — So large is the list of possible salads, that one knows scarcely which to select. Almost any vegetable, meat, or fish may be made into a salad.

For convenience they may be divided into four grades:

First ; those made from the herbs, cultivated or wild, given in the above list. These are, of course, uncooked, and may be used alone or combined with lettuce. They are served as a rule with a French dressing.

Second ; salads made with lettuce as a foundation, and uncooked fruits or vegetables, as, apple, nut and apple, orange, banana, apple and celery, tomato and cucumber. A mayonnaise dressing is generally used in these salads.

Third; salads made with lettuce as a foundation, and a cooked vegetable, as potato, asparagus, beet, cauliflower, rice, and bean. Mayonnaise or French dressing is used.

Fourth; salads made with lettuce or celery as a foundation, and meat, fish, or egg. Mayonnaise is served with all of these salads.

Preparation of Greens. — These should be as fresh and crisp as possible. To keep them in this condition until needed, place them in very cold water. If the ends of the stems are cut, and a little salt added to the water, they will revive more rapidly. They should be thoroughly washed, and dried with a soft, clean towel, then put in a cool place. Never mix the salad until it is to be served, as the acid wilts the greens.

French Dressing. — An old Spanish proverb says: "To make a good salad, four persons are required; a counsellor for salt, a miser for vinegar, a spendthrift for oil, and a madman to stir all together." The general rule for French dressing is twice as much oil as vinegar.

$\frac{1}{2}$ saltspoon salt, $\frac{1}{4}$ saltspoon pepper, black or white, 2 tablespoons oil, 1 tablespoon vinegar.

Put the oil, salt, and pepper in a bowl, stir until the salt is dissolved, then add the vinegar drop by drop, stirring all the time.

Onion juice may be added, and lemon juice may be used instead of vinegar.

A teaspoonful of mustard may be added to the vinegar if desired. Tarragon vinegar may be used.

The dressing should be creamy and of a grayish color, due to the division of the oil into small globules. If the oil separates, stir hard.

Salads made with French Dressing

Green vegetable salads, as lettuce, watercress, or any leaf salad; apple, celery, potato, cucumber, string beans, cold slaw, cheese, and yellow tomato.

Preparation of Olive Oil. — There is no tree in the world more interesting than the olive tree. Emblem of peace and hope, it was especially sacred to the Athenians, who endeavored to turn from the pursuits of war to the arts of peace and the cultivation of the soil. To the Christian, it has the added sacredness of sorrow, intensified by the gray-green foliage of the tree itself. The olive and vine are closely associated with regard to locality, both requiring an equable, mild climate. Thus to-day both flourish best along the shores of the Mediterranean.

Two forms of olive tree are known: the wild olive, with bitter, scanty fruit, growing in barren lands; and the cultivated olive, which is grafted upon the former. The olive tree grows very slowly, but lives for centuries. Thus, eight aged trees with gnarled trunks give unmistakable proof of the site of the "Garden of Gethsemane." One old tree near Nice is said to be one thousand years old.

Under the most careful culture the olive bears fruit in the fourth, fifth, or sixth year. The leaves are elongated, opposite, and smooth on the upper surface. The flowers, growing in clusters in the axils of the leaves, are whitish in color. The ripe fruit is deeply colored — dark red or purple, deep brown or black. To remove the bitter taste, which even the ripe fruit has, the olives must go through a special process before pickling in brine. A few sweet varieties, however, exist, the fruit being eaten when fresh from the trees.

To obtain the oil, the olives are first crushed between roll-

ers, sufficient pressure being used to crush only the flesh, leaving the pits whole. They are then put into sacks made of grass or crash, and placed under a press. The first oil to come from the pulp is considered the best. The pressure is increased until all the oil is collected. Then cold water is added, and the mess again pressed. A third pressing is then made, using hot water. After purifying, the oil is ready for the market.

The best olives for eating come from Spain; the best olive oil from Italy. The oil is useful in pharmacy, in the manufacture of soaps and for preserving sardines. The olive tree industry is rapidly growing in our own country, the Pacific slope offering one of the best olive areas in the world.

America received it from the Spanish.

Chili: here it flourishes as well as in its native home.

Mexico and Upper California: planted by Jesuit missionaries in the seventeenth century.

China, Australia, Cape Colony have recently received it.

Cotton-seed Oil. — A large amount of oil called "salad oil" is not olive oil, but refined cotton-seed oil. The best way to detect this substitution is by the odor, which is extremely unpleasant to most persons. The oil is not injurious.

Mayonnaise Dressing. — 1 cup salad oil, yolk of one egg, dash of cayenne, $\frac{1}{2}$ teaspoon salt, $\frac{1}{4}$ teaspoon mustard.

Add the mustard, salt, and pepper to the egg. Beat well. Add oil, which has been chilled, drop by drop, stirring always in one direction. When it gets too thick to stir, add a few drops of lemon juice or vinegar, then more oil, and so on until all the oil has been used. The bowl should be kept cold. Use a wooden or silver spoon.

If it curdles, beat up another yolk, and add slowly the curdled mayonnaise.

Boiled Mayonnaise. — 2 eggs, $\frac{1}{2}$ pint vinegar, $\frac{1}{2}$ tablespoon

mustard, ½ tablespoon sugar, ½ tablespoon salt, 1 pint milk, 1 tablespoon butter.

Add mustard, sugar, and salt to eggs and beat. Add vinegar and stir well. Then add milk slowly. Put into a double boiler, beating occasionally to prevent it from curdling. Do not allow the water in the under dish to boil too vigorously. When thick, like custard, add butter cut into small pieces. Beat again and remove from fire. It will take about half an hour to thicken.

This dressing will keep for some time in a cool place.

Salads made with Mayonnaise. — Chicken, all fish and meat salads, tomato, celery, cucumber, cauliflower, egg, nut and fruit, beet, rice, and celery.

Chicken and Meat Salads. — Allow half as much celery as meat. Cut the cold meat into dice, the celery, after scraping and washing, also cut into small pieces. Mix the two, and pour over it a French dressing, and put on the ice until ready to serve. Mix a little mayonnaise dressing with the chicken or meat. Arrange the salad in a dish, pour mayonnaise dressing over, garnish with celery leaves and capers or lettuce.

Rice Salad. — 1 cup cooked rice, 1 cup diced beet, 2 cups cut celery.

Season with ¼ teaspoon mustard, 1 teaspoon powdered sugar, dash cayenne.

Moisten with equal parts cream and vinegar.

First Lesson

1. Food value of Salad, { Acid, minerals, oil. May supply that which is lacking in the menu. }
2. Greens used for salad.
3. Preparation of greens.
4. French dressing.

5. Salads made with French dressing.
6. Preparation of one or two of these salads.
7. Fruit salad.

Method. — Have on the table as many of the salad greens as may be obtained at this season. Take the subjects in the order given. Let each student prepare two lettuce leaves and a small piece of celery, which are to be used in making the salads of the lesson.

Individual Rule for French Dressing. — 1 tablespoon oil, 2 teaspoons vinegar, $\frac{1}{4}$ saltspoon salt, dash of pepper.

Second Lesson

1. Economy in salads.
2. Salads made with meat, fish, or cooked vegetables.
3. Preparation of olive oil.
4. Mayonnaise with oil.
5. Boiled mayonnaise.
6. Salads made with mayonnaise.
7. Preparation of a meat or fish salad.
8. Preparation of a vegetable salad.

Method. — Emphasize the variety and economy of salads; also, the necessity for using only good oil, free from all unpleasant odor. This should always be kept in a cool place to prevent it from becoming rancid after opening the bottle.

Individual Rule for Mayonnaise Dressing. — $\frac{3}{4}$ saltspoon salt, $\frac{1}{8}$ saltspoon pepper, $\frac{1}{2}$ yolk of egg, $\frac{1}{4}$ cup of olive oil.

Follow directions given in large rule.

Individual Rule for Boiled Mayonnaise. — Heat one tablespoonful of vinegar. Add to it $\frac{1}{2}$ a beaten egg, and $\frac{1}{4}$ teaspoon salt, a few grains of pepper, and $\frac{1}{2}$ teaspoon butter. Place in a small improvised double boiler, and stir constantly until it thickens. If it becomes curdled, beat until it is smooth.

[No milk is used in the small rule.]

Chicken or Meat Salad. — Use any cold meat, preferably chicken or veal. Have this cut into small dice. Individual rule: Two rounded teaspoons meat, and one of celery. Mix with a little of the mayonnaise dressing. Put into a suitable dish. Pour the rest of the dressing over the top and garnish with celery leaves and capers.

Rice Salad (Individual Rule). — 1 full rounded teaspoon cooked rice; 1 full rounded teaspoon cooked beet, diced; 2 full rounded teaspoons cut celery, $\frac{1}{2}$ saltspoon seasoning — mustard, cayenne, salt, powdered sugar. Moisten with 2 teaspoons each of cream and vinegar.

FEBRUARY

THE DINING ROOM

By L. L. W. WILSON, Ph.D.,

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ADVANCED COURSE: BREAD, PASTRY, AND CAKE

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CHAPTER IX

THE DINING ROOM

By L. L. W. WILSON, Ph.D.

The Expert Waitress, Springsteed ; Waiting at Table, by a Member of the Aristocracy (English) ; What to Eat ; How to Serve It, Mrs. Herrick ; The Dining Room, Art Journal, vol. 31, p. 285.

Essays of Elia, " Grace Before Meat," Charles Lamb ; Miscellaneous Essays, De Quincey ; Feasts of Autolycus, ed. by Elizabeth Robbins Pennell ; Delicate Feasting, Theodore Child ; All the Year Round, vol. 20, pp. 104, 127 (Roman Dinners) ; Belgravia, vol. 16, p. 80 (Dining with a Mandarin) ; All the Year Round, vol. 67, pp. 5, 34 ; vol. 68, pp. 78–390 ; vol. 69, pp. 79–349 ; vol. 71, p. 535 (Famous Dinners) ; Cornhill Magazine, vol. 40, p. 590 (Dinners in Literature) ; Chambers's Journal, vol. 40, p. 367 (Uncommon Dinners) ; Blackwood, vol. 71, p. 734 ; Nineteenth Century, vol. 32, p. 203 ; Popular Science Monthly, vol. 14, p. 799 ; Living Age, vol. 165, p. 440 ; Cosmopolitan, vol. 3, p. 63 ; Chautauquan, vol. 23, p. 93.

Homer : Odyssey, Dinner of Penelope's Suitors ; Illiad, Priam's dinner, Niobe's dinner; Plutarch's Lives (Numa Pompilius), Petronius, Trimalchio's Banquet. This famous work has been recently translated by Harry Thurston Peck. Based on this famous feast are the descriptions of dinners in Bulwer's Last Days of Pompeii, Bekker's Gælus, and Sienkiewicz's Quo Vadis. Boswell's Life of Samuel Johnson. (Innumerable dinners famous for their company as well as the viands are here described.) Dean Swift's Conversations. Sir Walter Scott: Ivanhoe, Chaps. III–V; Waverley, Chap. XXIX ; Redgauntlet, Letter Four, Chap. XVIII (the Coronation Feast); Bride of Lammermoor, Chap. VII; Guy Mannering (Gypsy Cooking, Chap. XLVI and note); Kenilworth, Chap. XXXII (Banquet to Elizabeth); Talisman, Chap. III. Dickens: Christmas Carol (Bob Cratchit's Dinner) ; David

Copperfield (Dinner to Steerforth, Dinner to Micawber); Oliver Twist (The Workhouse Dinner, Chap. II); Pickwick Papers (dinners too numerous to mention). Thackeray: Vanity Fair, Chap. VII; The Newcomes, Chap. XIII (The Famous Dinner Eaten by Addison, Steele, and Harry Esmond). Disraeli: Vivian Grey, the dinner eaten by Vivian and the Marquis of Carabas; Lothair, dinner at Brent—at Mrs. Putney Giles.

The dinners of Sir Joshua Reynolds were famous, in their own day, with a reputation for good company and bad serving which has reached to the present generation. In a different way, the dinners given by the poet Rogers, and those by Lady Holland at Holland House, are equally well known.

Decoration of the Dining Room

As Theodore Child aptly said, the best decoration for a dining room is a well-cooked dinner. Yet, without doubt, that dinner will taste all the better in a room that is rationally furnished, tastefully decorated, and the temperature of which is maintained at an agreeable point.

The most famous dining room of ancient times was perhaps that of Lucullus, who built in it an aviary, so that as he ate the Roman dainty of thrushes he might, at the same time, feast his eyes on their living forms and tickle his ears with beautiful song. The revival of this idea in modern days, brought about, doubtless, by the discovery of the elaborate decorations of Pompeian dining rooms, in decorating the dining room with the stuffed skins of fish and game is even less commendable.

A dining room should be characteristic, light and gay, English ideas to the contrary notwithstanding.

One of the famous dining rooms of modern times is that designed by the artist Whistler for a London house. The walls are pale blue decorated with arabesques that recall the feathers of a peacock. Peacocks decorate the carved panels of the window-shutters, and on gilt shelves rests the blue and white China porcelain. One almost suspects that

this scheme of color and decoration was suggested by the dining rooms in the houses of those Chinese mandarins that chance to be of royal blood. For the walls of these rooms are hung with yellow, decorated with the dragons, and against these hangings rests their blue and white china.

Particularly does the notion occur to one who looks into Whistler's own dining room, for his walls are hung with canary yellow, and the only decorations are blue and white china.

Comte Molé used to change his decorations to suit his guests. For example, in giving a dinner to a foreign diplomat, pictures, flowers, plants, — all were such as were characteristic of the fatherland of his guest.

Lord Lonsdale went so far as to make the color scheme of the room such as would best suit the complexion, hair, and eyes of his beautiful guests.

Certain practical points, however, must be thoroughly taught before one can go even superficially into the æsthetics of the subject.

I. The dining room is in daily use.

II. It must be immaculately clean.

III. It must be beautiful.

IV. The cost of furnishing it must be within one's means.

For these reasons, the furniture should be plain but good, the colors gay but light, and the decorations for the most part plants, flowers, or perhaps an aquarium, rather than hangings of any kind.

A light rug is the nearest approach to a carpet that may be permitted.

The necessary things for a school dining room are: —

(1) A table, by preference round, or at least broad, rather than long and narrow.

(2) Chairs.

(3) The following china, the number in each case depending upon the number of students who will be doing practical work in this room at any one time: —

1 soup tureen	Bread plates
Soup plates	Sugar and cream set
Tumblers	Tablespoons
2 platters	Teaspoons
Dinner plates	Steel knives
2 vegetable dishes	Fruit knives
1 salad dish	Forks
Salad plates	Carving set
1 dessert dish	2 tablecloths
Dessert plates	1 felt
Coffee cups	Napkins

The additional desirable things are: —

A china closet	2 carafes
Bread-and-butter plates	Finger bowls
Olive dish	Coffee spoons
After-dinner coffee cups	Salad knife and fork
Salts and peppers	Doilies

The proper equipment of a dining room at a minimum cost has been discussed in the last chapter of this book.

Method. — Discuss with the girls the use of the dining room, the necessity for cleanliness, and the logical conclusion with regard to (*a*) floor, (*b*) hangings, (*c*) ornaments.

Tell them of various original and beautiful decorations. Let them suggest others, but in the end choose something quite plain for the school dining room.

Let them make lists of needed articles, and keep these lists for comparison with similar lists made after they have studied the room.

In the skeleton menus, given later, an effort has been made to present something practical, that shall represent what *should* exist in the *average* American family. If, however, the teacher's work lies with poorer people, she must adapt herself to the circumstances.

We have tried always to indicate specifically under each section how this may be done; but the matter is of so much importance that too much emphasis cannot be laid upon it.

Related Reading, Language, and Spelling Lessons

The menus, plans for setting the table, lists of dishes, order for serving and for cleaning already suggested will give abundant training in written language.

The references to general literature will suggest innumerable possibilities for oral language, and the "Reader in Domestic Science" gives varied and abundant reading matter with reference to various historical dinners, and the habits and customs of other nations and ages.

Breakfast

Facts. — The usual and average American breakfast consists of: —

Fruit

Cereal, Cream, or Warm Milk

Meat, or Eggs — Potatoes

Bread and Butter — Milk

[Hot Bread — Coffee]

This should be served in the four courses indicated.

That this meal shall be served and eaten properly, attention must be given to the following points: —

(1) The care of the dining room before breakfast.
(2) The setting of the table, side table, and sideboard.
(3) Preparation of bread, butter, and water.
(4) Serving the meal.

Care of the Dining Room before Breakfast

The room must be aired, put to rights, and dusted.

Except in the coldest weather, give the dining room a thorough airing, by opening the windows both at the top and at the bottom. The length of time during which the windows should be open depends entirely upon the temperature, and this can be accurately judged only by a thermometer. The optimum temperature is 68° F., since the occupants will be sitting quietly, and not at work.

Brush up the rug. Wipe the floor with a damp cloth, or dust mop, if it needs it.

With a cheese-cloth duster, dust carefully the table, chairs, side table, sideboard, window ledges, shaking the duster out of doors at the necessary intervals.

See that the mirrors, glass doors, and picture glasses are clean.

See that each article of furniture is in its proper place, and at its proper angle.

In setting the table, cover it first with a cover of double Canton flannel or felt. This protects the polished surface from hot dishes, and also makes even a handsome cloth look handsomer.

Over this, spread the table-cloth. The long middle crease must divide the table exactly in half.

Put for each person, a fruit plate, covered with a doily, on which rests a finger bowl, one-third full of water. See that each plate is symmetrically placed, both with reference to the table as a whole, and each of the other plates. At the right of each plate, place a silver fruit knife, with its

edge toward the plate. If a spoon is needed, put it to the left, with the bowl up.

Two tumblers should be placed at the right, and a bread-and-butter plate at the left.

On the right, again, put the breakfast knife and cereal spoon, and to the left, the fork, with the tines turned up, and the napkin.

Between the places for two people, place a saltcellar and spoon and a pepper, or put the salts and pepper at the top of each plate.

At the foot of the table, lay the carving cloth.

Put the carving knife and spoon to the right, and the fork to the left, of course, with the sharp edge of the knife facing the centre, and the bowl of the spoon and the tines of the fork up.

The carving knife must be sharpened with the steel each time before using it.

At the head of the table, place symmetrically, cups and saucers, sugar, cream, and a rest for the coffee-pot. This rest is to save the table from the heat, and should be made of the same material as the pot, china or silver, as the case may be.

In setting the side table, place on it the silver tray, a small napkin, a large napkin, leaving plenty of room for hot dishes and mats or trays to keep them from injuring the polish of the wood.

On the sideboard, put extra plates, knives, forks, spoons, tumblers, a bowl of granulated or powdered sugar for the cereal, a pitcher of cream, and a pitcher of water if carafes are not used.

Carafes are very desirable. In them the water may be sufficiently chilled to be agreeable, and yet not so much so as to interfere with digestion, provided they are put in the refrigerator over night. They save the waitress's time, a

very important matter, if the family is of any size. Moreover, they add to the appearance of the table.

See that the chairs are properly placed, that the doors and drawers are all shut, and that the newspapers are where they belong, probably at the right of the foot of the table, the seat of the master of the house.

Just before breakfast is ready to be served, place in the centre of the table the fruit. This should be clean and cool in reality as well as in appearance. It looks best in glass, and with no decoration except, perhaps, a few of its own leaves.

Put the butter and the bread on the table.

The most economical method of serving bread is to put the whole loaf on the bread board, and cut from it only what is needed. Because it is the less wasteful, it is the best way; but the waitress usually thinks differently, and prefers to cut a number of slices, several of which are sure to be unused, and too dry for anything except the bread-crumb jar.

Whichever method is pursued, the outer, stale slice (if the loaf is not fresh) must be removed, and only freshly cut bread used.

Last of all, pour the water into the tumblers.

When the family are seated, each removes from her fruit plate the doily and finger bowl, and spreads her napkin.

The waitress should place the fruit on the silver tray, and pass it to the mistress of the house, standing at her left. It is then passed to each person in turn, in the same way.

There is great difference of opinion and custom with regard to the order of serving when guests are present. The simplest way is that indicated; first, to the hostess, passing around to her right-hand guest, and serving the others in turn. For a large company, this is obviously the

best way; but when there are only a few present, many prefer to have the waitress serve, first the hostess, and then the other ladies at the table, before serving the gentlemen, regardless of the zigzagging often necessitated by this rule.

While the fruit is being eaten, replenish the water glasses.

Remove the fruit course as follows: First, the fruit dish, placing it on the side table; then the individual plates, each with its bowl, knife, and spoon, carrying them to the pantry.

Bring in the cereal.

This may be served by the mistress. In this case, set before her the individual dishes, with the tablespoon. Remove the cover to the side table. As she serves it, put the saucer on the tray, together with the sugar and cream from the sideboard, and pass it to each in turn. Or the individual dishes may be passed first, then the cereal, and then the cream and sugar.

Remove the cereal course as follows: First, the dish, placing it on the side table, covering it, and then each of the individual plates, in turn, until all are removed to the pantry.

For the next course, bring in the warm plates, putting them before the master of the house. Then put before him the platter, and on the sideboard the potatoes. When he carves a portion, place the plate with it on before the person for whom it was intended, standing at her right.

Uncover the potatoes, place a tablespoon in the dish, pass them.

Pass bread and butter.

Replenish the water.

Bring in the coffee-pot.

As the mistress of the house prepares the cup, set it down to the right of the person for whom it is intended, or

else pass, first, the coffee in a cup, and then the cream and sugar.

After breakfast, the food must be put away and the dishes removed.

Have a definite place for putting each of the following sets of dishes as they come from the dining room: heavy china, lighter china, glass, silver knives. The separate silver and knife pitchers are a great convenience.

Every particle of food that can be used again should be put away in its proper receptacle in the kitchen. Gravy, even so small a quantity as a spoonful of any vegetable, dressing from a roast, bones, should all be saved. They may be put in one receptacle, for the combination will make an excellent soup for lunch. Bread should be kept by itself, and, of course, meat and any vegetable of which there is a sufficient quantity for a second serving should each have its own place. It need hardly be said, that none of the dining room dishes should ever be found in the refrigerator.

After the food has been put away, empty every glass, cup, and pitcher. Fill the milk and cream pitchers with cold water.

Scrape the plates and other dishes carefully. Remember that a crust of bread cleans more effectually, and with less danger of scratching, than either a knife or a spoon.

A crockery or agate-ware bowl should be kept in a definite place to serve as a temporary receptacle for these scraps. Tin will not answer the purpose, because it will not long remain clean, since a bit of lemon or tomato will quickly rust it.

For washing dishes, the following articles are necessary: clean sink, dishpan, hot water, soap, soap shaker, Bath brick dust, board, cork and cloth, mop, dish drainer, dry towels, ammonia.

See that there will be plenty of room to place the dishes after they are washed.

Make hot suds in the pan. Remove the soap.

Wash the glass first, then the finer, lighter china. Wash quickly, set each set on the drainer, and dry thoroughly with towel. Put each set, as they are dried, in exactly the place left vacant for them.

Pour out the now cool water.

Make more hot suds, removing the soap.

Wash the silver. Place it on the drainer, pouring over it a pitcher of hot water. Dry quickly, and put it in its appointed permanent place, lest it be spattered with wet from the other washing.

If the water is still hot, wash in the same way the plates and other dishes, putting in only one kind at a time. These may be placed in turn on the drainer; but the clean water poured over them must not be too hot, or the finer china will be cracked, and its glaze gradually destroyed.

Be careful to wash thoroughly the insides of pitchers. After the milk pitchers are washed, it is a good plan to pour into them boiling water, and let them stand until all the other dishes have been dried.

Now for the knives. Their handles must never touch water. For this reason, the tin pitchers that come for this purpose are a great convenience; for in them the knives may be placed from the beginning, handles up.

In washing them, hold the handles in the left hand, and wash with the right. Then let the blades rest flat on the scouring board. Dip a cork or cloth in water, and then in powdered Bath brick, rubbing the steel until all stains are removed. Dry the knives with dry brick-dust, wipe with a soft cloth, and put them in the permanent place at once.

Put away all the dishes.

Pour out the last dish-water.

Put into the dishpan plenty of very hot water. To this add a little ammonia. Wash in it all the dish towels and hang them out in the air to dry.

See care of the sink in the section on cleaning in the chapter on The Kitchen.

Clean the table.

Sweep the floor.

Return to the dining room.

Air it, and, while the windows are open, remove the crumbs from the cloth, fold it in the old crease, put it and the napkins away.

Brush up the rug.

Class-room Lesson

Method. — Why do we eat in the dining room rather than our own bedrooms? How can we be sure that the air is sufficiently fresh? What else is important besides fresh air? What must we do in order to be sure that the dining room is clean? What else is necessary besides fresh air and cleanliness? How shall we secure order?

What is the use of a table-cloth? Is it thick enough? What can we do to make it thicker?

What dishes shall we put on the table?

Since this obviously depends on the food to be served, discuss with the students the question of breakfast dishes and courses.

Find out from the students their usual breakfast. The safest way to do this is to ask them to write for you, the day before, just what they had for breakfast on that day. This gives you the opportunity quietly to put yourself in touch with their mode of living and adapt your ideas to it. It will save you perhaps from riding rough shod over their prejudices and habits, and, better still, show you the easiest place for the entering wedge of something better.

If, for example, they belong to the poorer and poorest class in the city, it would be absurd to urge fruit and finger bowls, but worth a great deal to recommend a glass of water for a first course.

The cereals, however, should be urged upon them, for they are cheap, nourishing, easily prepared.

The third course will be given by all pupils. And from the hygienic point of view, since they are children and not adults, it is to be hoped that hot bread and coffee will be omitted by all. Nevertheless, they should be taught the proper serving of these articles of diet too.

Put on the board a general menu on the plan of the one at the head of this section, the best under the circumstances to which your pupils can aspire. Get from them the reasons for including each article. (See chapter on Foods). Let them name various cereals, various possible meat and egg dishes.

Then substitute for the word cereal, a cereal, and the meat or egg dish, a meat dish or eggs prepared in some particular style.

What dishes shall we need to serve each of these? Where shall we place them? Why? How? Why?

Obviously the answers to these questions depend largely upon the class of children. If no servant is kept in their homes, it is of doubtful utility to urge courses. On the contrary, everything should be within reach and the number of dishes reduced to a minimum; but with even one servant, there is no reason why all meals should not be properly served.

As a summary of the lesson, put on the board

Care of the dining room before breakfast: —

1. Fresh air.
2. Optimum temperature.
3. Cleanliness.

4. Order.

Menu.

List of dishes required for serving: —

China, glass, silver.

Require the students to bring in these skeletons filled out.

For the practical work the ideal method is, of course, to give each student the opportunity to do each part of the work herself. The grade teacher has the advantage over the special teacher in that she is there with the class all day, and that she can send one and another to the dining room to do this, that, and the other thing at convenient times to herself. She can take a moment for inspection — if she is a good housekeeper — and then, having the dishes replaced, begin all over again. But even the grade teacher will find it necessary to double up to a greater or less extent. Two girls can work to advantage at one time, and two more can criticise and perhaps improve upon the same work.

If it is a possible thing, however, have all the children, at one time or another, eat at least one meal under your supervision.

A capable teacher, who has her class well in hand, could supervise four cooks, three waitresses, twelve guests, using the rest of the class perhaps as assistant critics, requiring them to make notes, and discussing the matter with the entire class afterward.

Still, I am willing to admit that the question of sufficient practice in an ordinary grade school is difficult to manage, and the teacher must remember that the principles involved are after all equally important, and bring to their evolution and the subsequent necessary drill upon them all the resources that she employs in teaching other subjects.

1. Develop the principle, using the blackboards freely.
2. Apply these principles practically.

3. Be sure that both principles and applications are clearly defined in the child's mind.

4. Make a summary and require the children to give back to you the details which you have given them, or better still, not the same but similar details, coming from their own experience.

5. Practice under criticism.

6. Practice after criticism.

7. Practice in their homes.

Although dish-washing has been taught and practised in connection with cooking, yet these lessons on the dining room give the opportunity for a clearer understanding of the principles involved.

Class-room Lesson

What objection to putting the dishes as they come from the dining room in any order? Which dishes should be placed together? Why? Before the dishes are washed what must be cared for? How? Why? Why must the scrap bowl be of earthenware, or agate ware? What is agate ware? Its advantages, disadvantages, over crockery?

What things will be needed to wash the crockery, the glass, the silver, steel, dish-cloths? Why?

Which will you wash first? Why? How? Where will you put each article washed? Why?

Why must the handles of steel knives never be placed in water? Why is brick-dust used in cleaning them?

What must be done to leave the dining room in order?

Why must the dining room again be aired? What else must be done before you leave it? Why?

Dinner

Facts. — The usual and average American dinner consists of: —

Soup — Celery

Joint — Potatoes, one other Vegetable

Salad — Crackers and Cheese

Dessert

Coffee

This should be served in the five courses indicated.

Attention must be given to the following points: —

(1) The care of the dining room before dinner.

(2) The setting of the table, side table, and sideboard.

(3) Preparation of relishes, bread, water.

(4) Serving the meal.

Be sure that the air of the dining room is fresh and that the temperature is sufficiently low. If the dinner is served at night, by all means have the temperature below 68° F., for the lighting of lamps and gas will certainly raise it quickly, particularly if the room is small.

The room ought to be in order from the care given it after breakfast. See, however, that this is the case.

In setting the table, follow the directions given for breakfast, except, of course, that no fruit plate, knife, or spoons are to be placed on the table, nor is the coffee service to be put at the head of the table.

For the simple dinner indicated above, only a soup spoon, two forks, and a dinner knife, together with napkin, glass, salt, and pepper should be put at each place. The same rules obtain for their position at dinner as at breakfast, viz., spoon, knife, tumbler at the right; forks and napkin at the left. Put the soup ladle at the place of the mistress.

In the middle of the table, instead of a bowl of fruit, put a glass of flowers or a growing plant.

See that the sideboard is in perfect order, (1) in regard to its cover, (2) in regard to the position and condition of its more or less permanent articles.

For serving the dinner, be sure that the following articles are clean and in good condition: —

(1) Extra glasses, knives, forks, and spoons for an emergency.

(2) The dessert plates and forks. If fruit is served, then each plate should be provided also with a doily and finger bowl, as indicated for breakfast.

(3) After-dinner-coffee cups and saucers, spoons, small bowl of cut sugar, a small cream jug, and crackers and cheese, ready to serve.

On the side table place the carving knife and fork, salad plates, tablespoons, sauce ladles. Leave plenty of room for the vegetable dishes and gravy dish.

Take into the kitchen the soup plates, dinner plates, soup tureen, meat platter, vegetable dishes, placing them on the shelf above the stove. Care must be exercised, especially with fine china, not to put them where they will get too hot, for this will quickly crack the glaze. Without doubt, the best way to heat them is by passing them through warm water.

Put the salad bowl in the refrigerator, in which place also the olive dishes. Salted almonds, if used, may be placed on the table at once.

Put on each napkin, or if in its folds, still sufficiently out that it may be seen, a piece of bread cut into a slice about three inches thick and deep and four inches long, or else the regular dinner roll. Put reserve bread in a bread dish on the sideboard.

Put on the olives. Place the soup tureen and the hot

plates at the head of the table, pour the water, and announce the dinner by saying quietly, "Dinner is served."

After all are seated, remove the cover of the soup tureen, placing it on the side table.

As the soup is ladled out, from the left side take the soup plate and place it before whoever sits at the right of the mistress, standing while doing so on the right side. After all have been served, cover the tureen.

Pass the celery.

Replenish water glasses if this is necessary.

When all have finished the soup, remove the tureen.

Go to the right and remove each plate separately.

Place the roast before the carver, and the vegetables on the side table.

Put the gravy spoon and carving knife at the right, and the knife and the fork at the left.

Serve the meat in the manner suggested for the meat at breakfast.

Put a spoon in the potato dish and offer it on the tray at the left of each person, beginning with the mistress and passing to her right.

Serve the other vegetables in the same way. Nowadays vegetables are cooked dry enough to be placed on the dinner plates, dispensing almost altogether with the small dishes formerly used for vegetables.

Pass the gravy boat and spoon.

Pass olives.

Replenish water, and pass the bread to those who have none.

When all have finished, take the carving knife, fork, and spoon to the kitchen on tray; remove the roast. Then take off the plates, one in each hand.

Bring in the salad bowl, first putting in it the salad knife and fork, and place it before the mistress.

Serve as directed for the meat course.

Pass the crackers and cheese.

Remove this course in the following order: salad bowl, salad plates, tumblers, olives, all by hand. Put the pepper, salt, etc., on the tray.

Remove the carving cloth, by turning the corners together and placing it on the tray.

Remove with a crumb scraper all crumbs, bits of bread, etc.

Bring in the dessert to the mistress and serve as indicated for the salad.

If fruit is to be served, see directions for breakfast fruit.

A cup of coffee may be put at the right of each person, and cream and sugar passed at his left, or the coffee service may be carried into the parlor, or the dessert may be removed, and the coffee served as indicated for breakfast.

The directions for washing dishes have been given under breakfast.

Cut glass is of course not a part of the school outfit, yet direction for its care should certainly be given with the washing of the dinner dishes.

Cut glass may be most easily washed in warm water to which a little ammonia has been added. Use a soft brush — one comes for the purpose — to clean it thoroughly, and as it is wiped place it on a towel, or better still, in a bed of box or basswood sawdust. Pine sawdust will not do, because of the rosin which it contains, which will stick to the glass.

When the glass is removed from the sawdust, or from the towel, polish it with a soft cloth.

This is, of course, the simplest of dinners. To make it more elaborate, add raw oysters or clams on the half shell at the beginning, and fish after the soup.

Oysters should be served on top of a bed of finely cracked ice, and not covered with it. They should be put before each place just before dinner is announced. Pass at once to the left of the hostess and then from her right, a tray on which quarter lemons, horse-radish, red pepper, and crackers have been arranged.

Fish is served with a sauce, and sometimes with cucumbers, and sometimes with potatoes.

Each of these courses necessitates an extra fork. These may be placed on the table when it is set, but it is more usual nowadays to place at each place at the most two forks, and to put the others on just before bringing in the later courses.

If a still more elaborate dinner is required, it is usual to insert an entrée after the fish, and to put game or perhaps another entrée after the roast, preceding this often with a sherbet. This particularly American custom of introducing a half-frozen dish into the middle of the dinner amuses the epicures on the other side of the water.

"Why do you do it?" they say. And the only answer there has ever been given them is the decidedly fatuous reply: —

"Oh, to enable us to go on!"

And thus do we make a labor of our pleasures, and, in passing, ruin the digestion.

But with such dinners as these, we, as teachers, are not concerned.

Method. — Make use of the facts given with chapter on Foods to give the children the key to the making of menus.

Have clearly in your own mind, not an ideal dinner, but the best to which you can hope to train the children.

Put on the board the skeleton menu. Allow them to suggest other dishes that might be substituted. Lay em-

phasis on the relative food values, but do not forget at the same time the necessity for variety.

Let the children make out menus for spring, for summer, for autumn, and for winter.

What dishes are needed for each course? Where shall we put them? Why? How?

Let each girl prepare a menu, a list of the dishes for serving it, a plan for the setting of the table; also a plan for the setting of the side table and the sideboard, if these are to be considered.

Give them all the experience in practical work possible. See also the section on "Breakfast."

The Third Meal

Facts. — When the dinner is served at night, luncheon will be eaten in the middle of the day; but with the midday dinner an evening supper is the rule.

Luncheon or Supper

These are the family meals in which "left-overs" are usually consumed, and are therefore very variable in their content.

The following menu is the average perhaps: —

Meat dish — Potatoes, another Vegetable

Bread and Butter

Fruit and Dessert

Cocoa or Tea

The care of the room previous to luncheon has already been given.

Set the table as for breakfast, except that fruit dish, plates, knives, and spoons should be on the sideboard.

Put flowers or a plant in the middle of the table.

Prepare olives or pickles. The olives must be kept in the refrigerator until the last moment, but this is not necessary with pickles.

Serve precisely as indicated for the same courses in the section on breakfast and dinner.

Method. — It seems scarcely worth while to make more than a class-room lesson of these meals. The principles have been taught in the lessons on breakfast and dinner.

By all means, however, discuss these meals from the point of view of foods (see chapter on Foods), and let the students make menus subject to your criticism and direction.

It is an excellent plan to have faulty menus put on the board and criticised with reasons by the children themselves.

Weekly Cleaning

Facts. — *Utensils Needed.* Cheese-cloth dusters, brushes, feather duster, covers, broom, flannel or cotton flannel, carpet beaters, soap, ammonia, newspapers, turpentine or coal oil.

Clean the chairs, and take them out of the room.

If there is carving on them, a brush must be used. Then rub with a soft cloth. Leather may be washed with a cloth wrung out of hot milk. Rub until dry.

Roll up the rug. Take it out in the yard and hang it up on the line, — not by one corner only, since this will cause it to ravel later.

Put all the dishes from the sideboard and ornaments from the mantel on a paper which covers the table. Cover them.

Deftly shake out and tie back the hangings.

Open the windows. Shut all drawers and doors.

Dust the frames of the pictures. Brush the backs with a coarse brush.

Dust the tops of curtain poles and of mouldings.

Cover the pictures with unbleached muslin kept for the purpose.

Brush the dust from the corners of the window-sills. Wipe with a cheese-cloth duster.

Shake the duster out-of-doors.

Cover the broom with clean flannel or cotton flannel. Brush down the walls.

Wipe up the floor with a damp cloth. This may be tied around a broom.

When it is perfectly dry, rub it over with a very small quantity of coal oil or turpentine, which may be applied by hand, using clean cotton waste, or by putting it on a clean cloth tied over the broom.

For directions for cleaning windows see the section on "Cleansing," in the chapter on The Kitchen.

Clean in the same way mirrors and glass doors.

With carpet beaters, give the rug a thorough cleaning.

Relay the rug.

Dust the room thoroughly.

Shake all dusters out-of-doors.

Bring back the chairs.

Dust and replace the ornaments.

Remove covers.

Look over all the furniture, the woodwork, the hangings. See that everything is whole and in good order.

Wash all cloths in soap-suds with a little ammonia added to it. Hang them in the air to dry.

Clean brushes and hang them up.

Brasses and Silver. — These must be cleaned in the kitchen. The commercial preparations for cleaning brass all contain an acid. If this is not neutralized or removed, the metal will quickly tarnish. Therefore, after cleaning rub the articles thoroughly with whiting. See also the section on

"Cleaning," in the chapter on The Kitchen. Except in a moist climate, brass once properly cleaned will keep clean for a long time.

For the weekly cleaning of silver only hot water to which a little ammonia has been added, and soft cloths or a chamois for drying and polishing, are necessary. Whiting should not be used oftener than once a month. For this monthly cleaning cover the table with newspapers. Wash the silver in hot suds and dry it thoroughly.

Put some whiting in a saucer, mixing it to a paste with dilute ammonia. Rub this mixture on the articles to be cleaned, with a soft cloth.

Put each on the paper to dry.

When perfectly dry rub off the whiting with a clean, soft cloth, using a soft brush for the chasing, and the chamois for the final polish. If the silver is properly washed and dried each day, it will seldom be necessary to clean it.

Method. — Will the daily cleaning and airing of the dining room keep it in good order? Why not?

In cleaning a room what must be shut? What open? Why?

What would you do first? Why?

What utensils will you need for this? (Put on the blackboard the word *Utensils*, and write under the articles given.)

What next? Why?

Continue in this fashion until the process, its order, with reasons and utensils, have all been given.

Give the children practice, under criticism, if possible.

After some practice, require them to make a list of the order of cleaning and of the utensils necessary.

Table Manners

There are three ways to teach the subject: —

(1) By example.

(2) By precept.

(3) By eternal vigilance.

And all three ways must be employed to accomplish the object indicated, viz., automatic good breeding, based on quick intelligence and a kindly heart.

Obviously the grade teacher has comparatively small opportunity to do this work, but she can make a beginning, which most mothers will gladly supplement, or she may in her teaching supplement what many mothers have already begun.

Let her establish in conversation that the basis of good manners is deference to the comfort of others. Then make these facts clear to all: —

Consideration of others' demands on the part of the child.

(1) That she should offend neither the eye nor the ear.

Therefore, she must be (*a*) scrupulously clean; (*b*) erect in her bearing, neither lolling against the chair nor resting her elbows on the table; and (*c*) above all eat quietly and slowly.

In this connection the following details of customary etiquette may be taught: —

Spread the napkin across the lap, do not tuck it in at the neck.

Drink from the side of all spoons, never from the front.

Soup should be swallowed quietly from the side, and not the end of the spoon.

Do not tip the soup plate.

Break bread into a smaller piece. Do not bite mouthfuls from it.

Do not play with either the food or the table utensils.

Wipe the lips before drinking.

(2) That she should lighten the duties of the carver.

Therefore, she must (*a*) promptly indicate her preference for any particular cut, if he asks her to do so, and (*b*) help herself promptly to dishes that are passed her.

(3) That she should so manage all small details that the possibility of accident is reduced to a minimum. Therefore,

(*a*) In sending a plate back for a second helping she should put the knife and fork straight on the plate, and a little to one side. This will give room for the food, and obviate the possibility of their slipping from the plate.

(*b*) The spoon must never be left in the cup, but placed on the saucer.

(*c*) The soup spoon should be filled by moving it away from the person.

(4) That as host or hostess she should endeavor to make all others comfortable.

Therefore, in a family each should remember the tastes of the other members, and give to each the cut of meat, the amount of sugar and cream preferred by each, without asking. In the case of guests, it is of course necessary to ask.

With regard to passing things at the table, consideration of the comfort of others demands that if there is a waitress nothing whatever should be passed by any member of the family. If there is no waitress, however, then with each dish one must think of the possible wants of her neighbor, and see that these are satisfied.

In the latter case some little courtesy of expression is necessary in offering your service. Instead of saying abruptly, "Will you have the salt," for example, the phrase may be softened into "Let me pass you the salt," or "Allow me," or "May I," etc.

Plants and Flowers. — The dining room ought to be a

bright, sunny room. If it be so, by all means raise a few plants.

The cheapest house plants are geraniums. In the houses of the well-to-do they need intelligent care, but, as doubtless others have observed, in the houses of the poor they flourish in tin cans, and under what seems to be unfavorable conditions.

The secret of this, it seems to me, is that the houses of the poor are, perforce, cool to cold, and the geranium, like most plants, cannot endure hot, dry air. Neither can we, only we will not believe it.

The maximum temperature produced by artificial heat should be 68° F. for ordinarily healthy people.

Geraniums intended for house blooming should be prepared for it during the summer. To do this, follow the following simple rules: —

(1) Keep them in their pots.

(2) As soon as they are five inches high, pinch off the top, thus forcing them to develop side buds, and thus making compact, bushy plants. Keep up the pinching process until the shape of the plant suits you.

When you are satisfied with the plant, withdraw its supply of water, giving it only enough to keep it from drying up.

Remove every bud.

These last two things give the plant the rest that it needs, so that it can work hard during the winter.

Before bringing them into the house repot them. This is done by shaking the plants out of the pot, shaking off as much soil as possible, repotting in fresh, rich soil, with plenty of broken crock in the bottom for drainage, and watering them thoroughly.

The pots should be small. Otherwise the plants will run to roots and foliage, and will not bloom.

Leave them out-of-doors as long as possible.

When you bring them in, put them in the sunniest window of the coolest room.

Shower the leaves with a hand sprinkler, or by simply holding the foliage under a spigot, breaking the force of the fall, and at the same time scattering the water with the hand.

Do not water the earth too frequently. Wait until the surface is dry, and then give the plant a thorough wetting. The water should run through to the saucer.

About once a week give them some of the numerous ammoniacal plant foods. I have used Bowker's with great success; presumably the others are equally good.

The best geraniums for blooming are the *zonias*, or budding geraniums, of which the species are very numerous.

The double ivy-leaf geraniums are very beautiful, but the other fancy kinds are not very good for house plants, particularly for the amateur.

If your windows are not sunny, probably begonias will flourish best of all the flowering plants.

Give them plenty of plant food. If they drop their leaves, it is either because the room is too hot and dry for them, or because they are watered too much.

The easiest plants of all to care for, and, in the long run, the most satisfactory, if one does not expect bloom, are: —

Aspidistras, excellent plants of which may be bought from fifty cents to a dollar.

Rubber plants, costing from fifty cents to a dollar and a half, for small to medium specimens.

Pandanus (screw pines), costing about the same as the rubber plants.

Palms, which, however, cost considerably more, two dollars being about the minimum cost of a medium sized plant. The palms most useful for the house are the Kentias,

Phœnixes (date palms), Latania (fan palm), Cococos (cocoa-nut palm), and Areca. Of these, the best species for the purpose are, perhaps, *Kentia belmoreana, Phœnix reclinata* and *sylvestris, Latania borbonica, Cocos weddeliana, Areca lutescens.*

But the very best species of palms need more care than the plants mentioned before them. Their leaves must be kept clean by sponging them, they must get fresh air, and be shielded from the gas.

Cycads are among the best house plants, but their cost (from five to ten dollars for a medium size) makes it scarcely worth while to discuss them here.

Flowers, like plants, need a cool atmosphere.

Strip the leaves from the part of the stem under water. Cut off the ends of the stems, for an inch or so, every day, and do the cutting under water, so that the cut surface will not become full of air. Change the water every day. Keep them in a cold room, except when they are needed for the table.

Flowers so cared for should last at least a week.

An aquarium may be an ornament to the dining room.

Method. — In these days, every schoolroom is provided with plants and flowers. The most efficient way to teach children to care for them is to let each, in turn, take care of those in the school, after definite directions from you, and under your careful supervision.

Lamps

Since lamps are a necessity in some parts of the country, and considered ornamental in others, it will be well for the teacher to give a lesson on their care.

Cleanliness is the first essential, of course. Since we are dealing with oil, this can only be secured by strict attention to the following rules: —

I. Saturate the part of the new wick which is just above the burner; put the burner in the clean, empty lamp. Light the wick, and put on the chimney. Open the window, so that there is no draft on the chimney, and let the oil burn out. Rub the wick even with a bit of soft paper, but be careful to see that none of the charred bits are on the burner.

II. Fill the lamp carefully. Wipe the burner and other parts of the lamp. See that the chimney is clean. Light the lamp, keeping the flame low until the burner is heated. Then turn it up as high as possible.

III. Blow out the light.

IV. Turn the wick down, so that the oil will not ooze out at the top.

V. Boil the burners, when they become very oily, in water in which washing soda has been dissolved — a teaspoonful to the quart is the usual rule.

VI. Mica chimneys are more expensive than glass, but they are also less fragile. They will never break, but they scratch easily. If glass chimneys are used, put them into cold water, and bring it slowly to a boil. Then let them slowly cool. This tempers the glass, so that it is much less likely to crack.

Method. — In what respect are lamps difficult to keep clean?

How shall we (*a*) prevent and (*b*) cure this oiliness?

Why will soda clean the burners? See section on "Cleaning," in the chapter on The Kitchen.

CHAPTER X — (Advanced Course)

BREAD, CAKE, AND PASTRY

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"Here is bread which strengthens man's heart, and therefore is called the staff of life." — Matthew Henry's "Commentaries."

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One of the best books to be consulted by the teacher on the general subject of bread, especially with reference to its composition, digestibility, and food value is The Dietetic Value of Bread, by Goodfellow (Macmillan & Co.). An excellent statement of the chemical processes involved in breadmaking is to be found in The Chemistry of Cooking and Cleaning, by Mrs. Richards and Miss Elliott, (Home Science Pub. Co.), pp. 27–42, 52, 54. Food, by A. H. Church, is a standard authority (Chapman & Hall). The Chemistry of Cookery, by Matthieu Williams, is suggestive and interesting (Appleton & Co.). Practical, Sanitary, and Economic Cooking (the Lamb Prize Essay), by Mrs. Abel, should be read from beginning to end; pp. 91–106 discuss bread. An account of the commercial preparation of yeast may be found in Chemistry in Daily Life, by Lassar-Cohn (Lippincott Co.), pp. 87, 96, 108. A concise statement of the main facts regarding yeast and fermentation may be found in pp. 184–200 of Sedgwick and Wilson's General Biology (H. Holt & Co.). The Science and Art of Bread Making, by William Jago, is an exhaustive and scientific treatise on the subject (Simpkin, Marshall, & Co.).

Two pamphlets published by the U.S. Department of Agriculture are: The Carbohydrates of Wheat, Maize, Flour, and Bread, Bulletin No. 34, and Food and Nutrition Investigations in New Jersey, Bulletin No. 35.

The practical side of the question may be studied in Mrs. Lincoln's well-known books, in Miss Farmer's Boston Cooking-School Cook Book, in Mrs. Ewing's Bread and Bread Making, or in any of the good recipe books on the market. Excellent individual recipes by Miss Spring may be found in the American Kitchen Magazine for April, 1898.

Further references that will be found useful in presenting the subject, and making it attractive and interesting, are: Wheat: Commercial Geography, Chisholm; Commercial Geography, Tilden; Scribner's Monthly, vol. 22, p. 531; Popular Science Monthly, vol. 50, p. 101. Flour: The Nation, vol. 54, p. 424. Yeast: Huxley, Manchester Science Lectures. Bread: Lippincott, vol. 58, p. 704. Bread in the East: Penny Magazine, vol. 3, p. 2. Bread in Spain: Once a Week, vol. 1, p. 217. Bread and Cake Traditions: American Kitchen Magazine, vol. 7, p. 3. Tortillas: American Kitchen Magazine, vol. 7, p. 195; Boy Traveller in Mexico, Knox, p. 56. Festal Cakes: All the Year Round, vol. 40, p. 79. Biscuit Making (History of Crackers): Chambers's Journal, April, 1899.

BREAD

Bread was one of the earliest foods of man. That it was used long before history was written, the discoveries of modern times have shown us. In Switzerland, in the lake dwellings of prehistoric times, there have been found stones for grinding meal and baking bread, and even bread itself, in the form of round cakes. The first mention of bread in literature is in Genesis, in the words of Abraham to the angels, "I will fetch a morsel of bread." The Egyptians knew the art of breadmaking, and baked loaves and cakes in great variety of form and flavor. One ancient Greek writer names sixty-two kinds of bread in use; and in Rome there were many bakeries, where not only was the baking of bread done, but the grain was pounded and sifted, to prepare it for use.

In our own day bread is found in a great variety of forms, many of them characteristic of certain nations; familiar

examples are the black bread of Germany, the oat cakes of Scotland, the hard rye cakes of northern Sweden, baked only twice in the year, and the passover cakes or unleavened bread of the Jews. Bread forms the staple food of a large section of the human race, and is often the only means of subsistence of the very poor. Mr. Goodfellow, in some investigations made in London, found that in the worst districts fifteen per cent of the children ate only bread for the twenty-one meals of the week, while forty per cent more had other food only two or three times a week.

It is essential that so universal a food should be nutritious, palatable, and digestible. To fulfil these conditions, the flour used must be rich in nutriment; the bread must be light and porous, that as large a surface as possible may be exposed to the digestive juices; and the cooking must develop the flavor, and render the food materials more assimilable. Wheat produces a nutritious flour, containing all the food principles, though not in ideal proportions; it makes light bread, since it contains a large proportion of gluten, a sticky, tenacious, nitrogenous substance, which enables the dough to retain the gas formed in it; and it produces bread in which the starch is in a digestible form. Wheat has the further advantage over other grains: that the kernel can be easily separated from the chaff; that the yield of flour is large; that it is grown in almost every part of the world, in large amounts. In 1895 there were more than 2,400,000,000 bushels produced, largely in the United States, Russia, France, and India.

Wheat is a plant belonging to the grass family. It is classified as spring wheat and winter wheat, according to the time of sowing, the winter wheat being planted in the fall. It is also known as hard and soft, and as red or white wheat. The very hard variety is grown in Italy, and is used in the manufacture of macaroni. If a grain of wheat

be soaked for a few hours in water and a thin cross-section cut, there may be plainly seen under the microscope four distinct layers. The two outer coats are bran, the third, also considered part of the bran, is made up of square or oblong proteid cells; and the inner part, or endosperm, consists of large cells of irregular shape, containing starch cells lying in gluten. If a drop of iodine be put upon the section, the starch will become blue, and be clearly distinguishable from the rest of the grain. The composition of wheat varies with the kind, the climate, and other conditions. Professor Atwater gives as the average composition of one hundred samples of wheat flour: water, 12.5 %; proteid, 11.3 %; fat, 1.1 %; carbohydrates, 74.6 %; mineral matter, 0.5 %.

The manufacture of flour from wheat is a complicated process, and its methods change from year to year. Its essential parts are as follows: first, the cleaning of the wheat, and the separation of the good grains from the imperfect ones and from foreign material; second, the crushing or cutting of the wheat, either by the old method of grinding between stones, or by the new process in which the grains are passed between a series of grooved rollers; third, the bolting or sifting by which the bran is separated from the "middlings," and the different grades of flour from one another. In the whole wheat flour the bran is ground with the middlings, and forms part of the flour.

Though the earliest form of bread was made simply by mixing flour and meal with water, and baking it, the tough, hard cake thus formed was neither very digestible nor wholly palatable. Experience probably taught that a light porous dough was more desirable, and so a leavened bread came into use. Doughs, or batters, are made light by means of some gas, which, by its expansion, forms a spongy, porous mass. Sometimes air is the gas used, and is beaten into the batter to make it light, as in the case of sponge cake; but

more often carbon dioxide (often called carbonic acid gas) is introduced. Carbon dioxide may be formed in the dough in two ways: first, by the action of an acid upon a carbonate, such as baking soda; and second, by the growth of yeast, and the consequent fermentation of sugar. The latter is the oldest method of producing the result, and in spite of many efforts to introduce other processes, is still the most satisfactory. The ancient leaven was made by mixing flour and water together, and letting it stand until it fermented, and in some places "salt rising bread" is still made in the same way. The fermentation is caused by the wild yeast cells that are always floating in the air, and that fall into the exposed liquid. It is these wild yeasts which cause the change of apple juice into cider. The objection to this method of obtaining yeast is that bacteria and moulds, as well as different varieties of yeast, find access to the liquid, and often cause acetic or other acid fermentation, and give a sour or bitter taste to the bread.

Yeast is a tiny, one-celled plant, about one two-thousandth of an inch in diameter, belonging to the class of budding fungi. The scientific name is *Saccharomyces cerevisecæ*. Under the microscope the yeast cell is seen to be round or oval, consisting of a cell wall filled with protoplasm. In the young, fresh cell, the cell contents appear clear and homogeneous; but as the yeast grows older, the protoplasm becomes granular, and fat droplets and vacuoles appear. If a growing cell be watched, a bulging of the wall near one end of the cell will be seen, and this gradually increases until a new cell is formed. This daughter cell finally becomes detached from the parent cell, but often it first forms buds in its turn, so that a chain of cells is seen, each cell representing an individual plant. This method of reproduction is called budding. Under certain conditions of temperature and moisture, there appear in the interior of

the yeast cells two, three, or four rounded bodies called spores. These expand, and become surrounded with a wall; the wall of the mother cell is ruptured, and the spores are set free as new cells, to bud, and produce a new generation of yeast.

Yeast, like other living things, requires food. Moisture, oxygen, some nitrogenous matter, salts or mineral matter, and carbohydrates, especially sugary substances, are needed for its growth. The temperature is also an important factor, 70° to 85° F. being the most favorable for active growth. The cells, when moist, are killed at a temperature varying from 130° to 150° F., though, when dry, they can sometimes withstand a temperature of 212° F. Yeast is rendered inactive by a low temperature, though it can withstand cold better than heat.

Three kinds of yeast are in use for breadmaking, liquid (home-made or baker's), dry, and compressed yeast. Liquid yeast is prepared from potatoes, sometimes with the addition of a few hops, sugar, and enough yeast to start the fermentation. It is used less than a few years ago, since the convenient yeast cake has come into use. Dried yeast finds its sale chiefly among those too far from market to procure fresh yeast. It is possible to make good bread with it, but not so easy as with fresh yeast.

In most general use, at least near the large centres of population, is compressed yeast, a by-product in the manufacture of whiskey. It is prepared by skimming the masses of yeast from the surface of the fermenting liquid, sifting it to take out all coarse particles of material, and washing by repeatedly adding and drawing off fresh water. Starch is then added, and the whole mass is formed in large cakes and sent to the point of distribution, where it is cut and wrapped in tinfoil. One cake, sold for two cents, is said to contain about sixty billion yeast cells. The advantage of

this form of yeast is that it contains only one species of yeast, and that, when it is fresh, there are fewer bacteria present than in most home-made yeasts. A fresh cake is essential for good results.

The property of yeast of which we make use in bread-making is its power to change certain kinds of sugar into alcohol and carbon dioxide; that is, to ferment sugar. When yeast is added to the flour and liquid, which are the essential ingredients of bread, and the whole is allowed to stand at a temperature of from 70° to 80° F., complicated chemical changes take place. The most important of these are: first, the conversion of part of the starch of the flour into sugar, accomplished by a ferment sent out by the yeast, or perhaps by a ferment present in the flour itself; second, the change of the sugar into alcohol and carbon dioxide, a direct result of the growth of the yeast. The chemical reactions may be expressed as follows:

$$\underset{\text{Starch}}{C_6H_{10}O_5} + \underset{\text{Water}}{H_2O} = \underset{\text{Sugar}}{C_6H_{12}O_6} \text{ (dextrose)}$$

or,

$$2\,C_6H_{10}O_5 + H_2O = C_{12}H_{22}O_{11} \text{ (maltose)}$$

$$\underset{\text{Dextrose}}{C_6H_{12}O_6} \quad (+ \text{ yeast}) = \underset{\text{Alcohol}}{2\,C_2H_6O} + \underset{\text{Carbon Dioxide}}{2\,CO_2}$$

$$\underset{\text{Maltose}}{C_{12}H_{22}O_{11}} + H_2O\ (+ \text{ yeast}) = 4\,C_2H_6O + 4\,CO_2$$

If bacteria are present, a further chemical change may take place, and the alcohol be converted into acetic acid, thus making the bread sour.

The reaction is

$$\underset{\text{Alcohol}}{C_2H_6O} + \underset{\text{Oxygen}}{O} = \underset{\text{Acetic Acid}}{C_2H_4O_2} + \underset{\text{Water}}{H_2O}$$

If perfectly pure yeast could be obtained, sour bread would be unknown. Since this is not practicable at present, we

must guard against the souring of the dough by stopping the fermentation at the right stage, and by avoiding a high temperature, favorable to bacterial growth and deleterious to the best development of the yeast.

The baking of bread accomplishes several objects: the living yeast and other organisms are killed; the alcohol and carbon dioxide are driven off; most of the starch grains are burst, and the starch is thoroughly cooked and thus made more digestible; some of the starch is changed to dextrin, a more soluble and therefore more easily digested carbohydrate; the loaf is browned by the change of some of the sugar to caramel. To accomplish these results, to stop the fermentation quickly that the bread may not sour, and to make certain that sufficient heat penetrates to the middle of the loaf, a temperature of from 400° to 450° F. is necessary.

The process of breadmaking, as we practise it, consists in mixing flour with a liquid, either water or milk, adding yeast, salt, and often sugar and some kind of fat; allowing the mixture to rise; shaping it into loaves and letting it rise again; and baking it. The essential ingredients are the flour, liquid, and yeast. Sugar may be added to hasten the process, since fermentation takes place more quickly when it is present, and shortening (or fat) makes the loaf more tender. Milk gives a more tender bread than water, but one which will not keep so long, and for some people is less digestible, because of the possibility of the formation of lactic acid from the milk. If milk is used, it must be scalded to destroy the bacteria present. A good result is given by the use of half water and half milk. Bread is usually kneaded to insure thorough mixing of the ingredients and even distribution of the gas bubbles in the dough. Kneading may also render the gluten more elastic. Excellent bread may be made without kneading, however, if care is taken to mix thoroughly the materials. Many bread-

makers like to knead slightly because the "feel" of the dough tells more surely than anything else when the right consistency has been obtained. The kneading, if preferred, may be done between the first and second rising. If done then it is more effective in evenly distributing the gas, but care must be taken not to make the bread dry by kneading in too much flour. Bread may be set at night, allowed to rise all night, and baked in the morning, or it may be made by the quick process now coming into quite general use; that is, it may be set in the morning, a larger quantity of yeast used, and the whole process carried through in from four to six hours. In the slow process one-fourth of a yeast cake is allowed to a pint of liquid; in the quick process one whole cake or even two may be used. The texture of the bread made by the two methods will differ somewhat; that made by the slow process will contain more dextrin and sugar, and will perhaps be slightly more digestible. The quick method, however, has the great advantage that the whole process can be watched, and the temperature more carefully regulated, so that the bread is less often sour. By using a large amount of yeast, and whole wheat flour, one may carry through the whole process of breadmaking in a school lesson of two hours, if it is necessary.

The general rule for both the first and second rising of the bread is that the dough shall be allowed to double its bulk. When risen just enough, it should be soft and velvety, but not sticky, to the touch, and very elastic. It should always be covered during the rising, to keep out the air and prevent the formation of a hard crust. A simple method of testing the temperature of the oven is as follows: place a teaspoonful of flour on a plate in the oven; if it browns in five minutes the oven is hot enough for a loaf of bread; if in one minute it is right for rolls. No test, however, can be a substitute for experience. After a short time the heat

may be lessened that the crust may not burn before the loaf is thoroughly cooked. The time for baking must be sufficient to allow the heat to penetrate to the interior of the loaf; and to insure thorough cooking the loaves should be small. Slack-baked loaves not only are indigestible because of the uncooked condition of the starch, but often contain living bacteria or moulds. The interior of the loaf never becomes hotter than 212° F., because of the moisture present, and the temperature of the middle of a slack-baked loaf may remain far below that.

As soon as the loaves are taken from the oven they should be removed from the pans, and left until perfectly cool in such a position that the air can circulate freely around them.

Experiments. — I. The composition of flour. Mix half a cup of flour with water to form a stiff dough. Put it into a piece of cheese cloth and knead it thoroughly under water till nothing more can be washed out. Test with iodine the white powder of the washings. The blue color will prove it to be starch. Examine the tough, elastic substance which remains in the cloth. This is gluten, the chief proteid in the flour. Both the starch and gluten may be dried and kept for further examination.

II. To show the difference between wheat flour and that from other grains, as a material for breadmaking, mix flour and water; corn meal and water; rye flour and water; and compare the doughs formed.

III. The effect of temperature on the growth of yeast. To a cup of boiling water add 2 tablespoons of molasses, and $\frac{1}{8}$ of a yeast cake, crumbled into bits, and turn the mixture into a tumbler. Add an equal amount of molasses and yeast to a tumbler of ice water, and also to a tumbler of water at a temperature of about 80° F. Set the glasses aside in a warm place (about 80°) for an hour or two. Notice the

time when bubbles, indicating the formation of gas, begin to appear in each liquid. Compare the amount of gas formed under the different conditions of temperature.

IV. (For older pupils.) Fill a test-tube with a molasses and water mixture at a temperature of about 80°, and add a little yeast. Invert the test-tube in a shallow dish containing also some molasses and water. Support the test-tube in some way and let the whole stand for twenty-four hours. The test-tube will then be found to be nearly emptied of liquid, and filled with a colorless gas which has forced the liquid out. The gas may be proved to be carbon dioxide by its power to extinguish a lighted match, and to turn lime water milky, the usual tests for this gas.

Recipes

(All measurements are level)

Bread

1 pint liquid (milk, or milk and water), 2 tablespoons of butter, 1 tablespoon of sugar, 1½ teaspoon of salt, 1 yeast cake, moistened with ¼ cup of water. Flour to make a dough stiff enough to knead (about 6 cups).

Individual Rule.—¼ cup of milk, 1 teaspoon of butter, ½ teaspoon of sugar, ¼ teaspoon of salt, ¼ yeast cake, mixed with 2 tablespoons of water, about 1 cup of flour.

Directions.—Scald the milk, add the butter, sugar, and salt, and cool to 80° F., or until it feels *cool* to the finger. Break the yeast into bits, and mix it thoroughly with the water, at a temperature of 80°; add it to the milk, and stir in the flour gradually, using a knife or a wooden spoon. When the dough is just stiff enough to make into a smooth ball, knead it on a slightly floured board till smooth and elastic. Return it to the mixing bowl, cover closely with a

cloth and tin cover, and let it rise till double its bulk, keeping it at a temperature of about 75°. Shape into small loaves; place in the pans; cover and let rise till it again doubles its bulk. Bake in a hot oven (400° to 450°) for about fifty minutes.

NOTES. — 1. Unless the water is known to be pure, it should be boiled and cooled.

2. A good breadmaker leaves bowl, spoon, and board clean. From the time the wheat is harvested until it is made into flour nothing is wasted. From the time the flour is delivered at the house until the bread is used, much is wasted in the ordinary household. This should not be.

3. Part of the dough, instead of being shaped into loaves, may be made into rolls. Roll the dough to thickness of half an inch, cut it into rounds; with the fingers draw out each piece to an oval shape; press nearly through the centre with the handle of a clean wooden spoon, dipped in flour; rub a little melted butter on one half and fold the other half over it so that the edges meet. Let rise till very light, and bake in a very hot oven. If dough is set especially for rolls, the amount of shortening given in the rule may be doubled.

Whole Wheat Bread. — Bread made from entire wheat flour is more nutritious than white bread. It is particularly rich in mineral salts, but is somewhat less digestible than white bread, and, as part of a mixed diet, has no especial advantage over it. When bread is used as the chief article of diet, however, it is essential that it should have as high a food value as possible. Graham bread, though useful for some people, is undesirable for many, because of the coarse particles of bran which it contains.

Rule. — 2 cups of milk, $\frac{1}{4}$ cup of sugar, $1\frac{1}{2}$ teaspoon of salt, 1 yeast cake mixed with 2 tablespoons of water, about 4 cups of entire wheat flour.

Directions. — Scald the milk, add salt and sugar, and cool; add the yeast and flour, and beat thoroughly. Let rise in the bowl, and when double in bulk pour into pans; let rise again, and bake.

Individual Rule. — $\frac{1}{4}$ cup of milk, $1\frac{1}{2}$ teaspoon of sugar, $\frac{1}{4}$ teaspoon of salt, $\frac{1}{8}$ yeast cake in 1 teaspoon of water, $\frac{1}{2}$ cup of entire wheat flour.

If it is desired to carry through the process in two hours, use $\frac{1}{2}$ a yeast cake.

The Presentation of the Lesson. — The facts given in this chapter are for the teacher, not necessarily for the pupil. The judgment of the teacher alone can determine what should be presented to her particular class. As a rule, the simpler facts, easily understood, are more profitable for the pupil than the more elaborate and scientific side of the subject. For example: a knowledge of the wheat plant, its habitat and structure, the ability to recognize it wherever seen, familiarity with it in literature and art, mean more to the child than any explanation of the chemical reactions which take place by the action of yeast. A child who has never heard of carbon dioxide nor of alcohol in connection with bread may have gained more from the bread lesson than one who can glibly talk of these things, but whose conception of the whole process is hazy, whose manipulation is poor, and whose power of applying theory to practice is undeveloped.

The number of lessons given to the subject will also depend upon the class, and the amount of time available. A satisfactory division of the work is as follows: —

LESSON I. STUDY OF MATERIALS.
Experiments with flour, and with yeast.
Demonstration by the teacher.

LESSON II. REVIEW OF THEORY.
Shaping into loaves and rolls, and perhaps bread-sticks, of dough already mixed by teacher and once raised; raising and baking it.

Setting a fresh portion of bread. (This may be carried home to bake, if the children so desire.)

LESSON III. WHOLE WHEAT BREAD. The whole process carried through in one lesson.

LESSON IV. USES OF STALE BREAD.
Bread pudding (plain or chocolate), cheese pudding, or cheese straws, and similar dishes made.

If this division of lessons occupies too much time, the demonstration by the teacher may be omitted, and the setting of bread by the pupil may be included in the first lesson. In the second lesson the dough prepared by the teacher may be used, and some pupils may be selected to carry through the whole wheat bread process; the last lesson may be omitted.

The outline here given is intended to be merely suggestive.

Outline.

I. INTRODUCTION.
  a. History of bread; allusions in literature.
  b. Kinds of bread in use.
  c. Value as a food.
    1. Food principles present.
    2. Digestibility.
  d. Comparative value of different kinds.

II. STUDY OF WHEAT.
  a. Facts concerning it; where grown, etc.
  b. Structure of the grain (under microscope if possible).
  c. Manufacture of flour.

d. Composition of the flour; experiment showing starch and gluten.

e. Superiority over flour from other grains for breadmaking; experiment.

III. Yeast.

a. Description.

Form, size, method of growth.

b. How obtained; different kinds in use.

c. Conditions of growth.

1. Moderate temperature.
2. Moisture.
3. Food { Nitrogenous matter. / Mineral matter. / Sugar.

Temperature illustrated by experiment.

d. Chemical changes caused by its growth.

IV. Process of Breadmaking.

a. Rule given.

b. Reason for use of each material; essential and non-essential materials distinguished.

c. Manipulations.

Mixing, kneading, raising; importance of temperature.

d. Baking.

1. Reasons for.
2. Principle of cookery.

V. Care of Bread.

a. Care on taking from the oven.

b. The keeping of bread.

c. Uses for stale bread.

Baking Powder Mixtures

It is often desirable to use a quick method of raising dough. Many expedients have been tried, but one of the

most satisfactory is the production of carbon dioxide by the use of so called "baking powder." Baking powder is usually composed of "bicarbonate" of sodium (commonly called baking soda), cream of tartar, and starch.

Baking soda, like all carbonates, readily gives up carbon dioxide upon treatment with an acid, and cream of tartar is the most convenient acid to use in practice, since it acts on the soda only in the presence of warmth and moisture, and the residue left after action ceases (Rochelle salt) is comparatively harmless. The starch is added because by its power of absorbing moisture it keeps the other ingredients dry. The chemical reaction which takes place when baking powder is used is as follows: —

$$\underset{\text{Bicarbonate of Sodium}}{NaHCO_3} + \underset{\text{Potassium Acid Tartrate}}{KH(C_4H_4O_6)} = \underset{\text{Rochelle Salt}}{KNa(C_4H_4O_6)} + CO_2 + H_2O.$$

Baking soda has a molecular weight of 84, and cream of tartar of 188. This means that the proper proportion in which to use them, so that there shall be no excess of either, is 84 parts, by weight, of soda, to 188 parts, by weight, of cream of tartar. An excess of the acid gives a sour taste; an excess of the soda, which is an alkaline substance, not only gives a disagreeable flavor, but hinders digestion.

For this reason it is better to use baking powder, for which the ingredients have been carefully weighed out, than to buy soda and cream of tartar and mix them one's self. Soda is often used in cookery and the necessary acid furnished by sour milk or molasses. In this case one teaspoonful of soda is usually allowed to one cup of molasses or one pint of sour milk.

Baking soda is manufactured from common salt. Cream of tartar is obtained from the inside of wine casks, where it is deposited by the fermenting grape juice. It is then a

purplish crystalline substance known as argol, and must be purified by dissolving, filtering through charcoal, and recrystallizing, before it is put upon the market as cream of tartar.

Baking powder biscuit, and similar mixtures, should be made into as soft a dough as it is possible to handle, should be handled as little and as quickly as possible, and baked immediately in a hot oven.

The proportion of baking powder to be allowed for each cup of flour is from one and a half to two teaspoonfuls. When eggs are used, as in cake, less baking powder is needed.

Rules

Baking Powder Biscuit. — 2 cups flour, 2 tablespoons butter, 3 teaspoons baking powder, $\frac{3}{4}$ cup milk, 1 teaspoon salt.

Individual. — $\frac{1}{3}$ cup flour, 1 teaspoon butter, $\frac{1}{2}$ teaspoon baking powder, 2 tablespoons milk, $\frac{1}{8}$ teaspoon salt.

Beef drippings, or other fat, may be substituted for the butter.

Directions. — Mix the dry ingredients and sift twice. Work in the butter with the tips of the fingers, and add the milk very gradually, mixing with a knife till a soft dough is formed. It may be found necessary to vary the amount of milk. Turn the dough on a floured board and roll lightly till it is about half an inch in thickness, cut into rounds, place in a greased pan, and bake in a hot oven about fifteen minutes.

Short Cake

Use the rule for biscuit, adding, to the whole amount, 2 more tablespoons of butter, and 1 tablespoon of sugar. Mix, roll out to half an inch thickness, shape into two large rounds, place one upon the other, and bake. When done, split open, spread with a little butter, and fill with sweetened fruit: strawberries, oranges, or peaches.

Dutch Apple Cake

Use the short cake rule with the addition of one egg, beaten, and added with the milk. Make the dough a little softer than for biscuit, spread in the pan, without rolling, and stick into it, in even rows, thin slices of apple. Sprinkle with sugar, and bake. This may be served with a sauce if desired.

If more variety is wished, part of the biscuit dough may be rolled thin, spread with a little butter, sprinkled with cinnamon and sugar, and rolled like jelly roll. Slices three-quarters of an inch in thickness may be cut, laid in a pan, with the cut portion down, and baked. Chopped apple may be used instead of the spice.

Another lesson may be given to breakfast muffins. Several different kinds should be chosen, such as graham, rye, corn meal, white muffins, assigned to different workers, and the children led to see that the principle is the same in each case. Muffins should be mixed to the consistency of a batter, not a dough. Usually a "drop" batter is used for them, — that is, a batter that will break as it falls, not pour in a continuous stream.

The following outline for the study of baking powder will suggest some simple experiments which may be given.

Baking Powder.

I. Introduction.

Methods of making doughs and batters light.

a. By means of carbon dioxide, obtained:

1. From the growth of yeast.
2. From the action of an acid upon a carbonate.

b. By means of air.

II. Acids.

Definition. Test (means of recognizing).

Familiar acids (vinegar, lemon juice), tested by litmus paper, and tasted.

Cream of tartar proved an acid, by power to redden litmus and by taste.

III. CARBONATES.

Meaning. A compound from which a gas (carbon dioxide) can be set free. Illustration, a piece of marble and an acid.

Baking soda tested with litmus, and tasted and shown to have properties opposite from acid (alkaline); proved a carbonate by the addition of an acid.

IV. EFFECT OF MOISTURE AND HEAT ON SODA AND CREAM OF TARTAR.

Add cold and hot water each:

a. To soda.

b. To cream of tartar.

c. To a mixture of the two, and compare results.

V. COMPOSITION OF BAKING POWDER.

Add hot and cold water to baking powder, and compare results with IV.

Mix a little baking powder with water and boil. Notice the consistency of the liquid, and test it with iodine.

VI. MANUFACTURE OF BAKING POWDER.

Source and preparation of chief ingredients.

Reason for adding starch.

Reasons favoring its use.

VII. SUBSTITUTES FOR BAKING POWDER.

Soda and sour milk.

Soda and cream of tartar.

CAKE

Cake is a mixture of flour, liquid, eggs, and sugar, with or without butter, made light by the use of yeast, as in the old fashioned "election cake"; by air beaten into the batter, as in many sponge cakes; or, most often, by the use of baking powder. The egg, like the gluten of the flour, retains the gas till the cake is set by the heat. Gingerbread, and plain dark fruit cake, are often made with soda and sour milk, part of the acid being supplied by the molasses used. In these the egg is sometimes omitted. Cake made with butter is cup or pound cake, as the materials are measured or weighed. Sponge cake is always made without butter.

The following are the general rules for cakemaking: —

1. The oven should be ready before the work is begun. An oven which will turn a piece of white paper dark yellow in five minutes is considered right for cup cakes. Sponge, and fruit, or pound cakes, require less heat, and the test paper should turn light yellow in five minutes when the oven is right for them. If there is too much heat the gas will escape from the cake before the egg has time to set, and the cake will fall; if the oven is too slow the cake will not rise sufficiently, and will be of coarse texture. Layer and small cakes need more heat than loaf cake.

2. All materials should be ready, and the pans greased, and lined with paper, if loaf cake is made, before the work of combination begins.

3. For butter cake the general rule for combining ingredients is as follows: Cream the butter, add the sugar gradually, then the beaten eggs, and beat vigorously; add the flour, sifted with the baking powder and salt, alternately with the milk; flavor, add nuts and fruit dredged with flour, if any are to be used, and bake immediately. A more delicate cake is made by separating the yolks and whites of the

eggs, adding the beaten yolks to the butter and sugar, and cutting or folding in the stiffly beaten whites just before putting the cake into the oven.

For sponge cake beat the egg yolks till thick and yellow, add the sugar gradually, then the stiffly beaten whites, and last of all fold in the flour sifted with the salt.

4. The mixing is most easily done with a wooden spoon. A Dover egg-beater, or a wire whisk, is the most satisfactory utensil for beating the eggs. After adding the eggs, beat the mixture rather than stir it, in order not to break the air bubbles formed.

5. Pastry flour gives a more delicate cake than bread flour. If the latter is used, a little less is required than of pastry flour. The flour must always be sifted before measuring, as in all cookery, and sifted again when the baking powder has been added. Fine granulated or powdered sugar gives a cake of finer texture than a coarse sugar.

6. A layer cake will bake in twenty minutes, while a loaf requires longer, the time varying with the size of the loaf. The cake is done when it shrinks from the edge of the pan, and when it springs back into place after pressure with the finger.

7. When taken from the oven the cake should be removed from the pan, and left to cool upon a wire cake-cooler. It should be kept in a tin box or closely covered jar.

Rule.

Cup Cake. — 2 cups sugar, $\frac{2}{3}$ cup butter, 3 eggs, 1 cup milk, 3 cups flour, 3 teaspoons baking powder, 1 teaspoon flavoring (lemon or orange), $\frac{1}{4}$ teaspoon salt.

Individual Rule. — $\frac{1}{4}$ cup sugar, $1\frac{1}{2}$ tablespoon butter, $\frac{1}{2}$ egg, 2 tablespoons milk, $\frac{1}{2}$ cup pastry flour, $\frac{1}{2}$ teaspoon baking powder, 8 drops of flavoring, sprinkling of salt.

The cake is to be put together by the method given above for mixing butter cakes.

With this simple foundation a variety of cake may be made. Not only may different flavors be used, and some of the cake frosted, but to one may be added: —

$\frac{1}{2}$ teaspoon of molasses, 2 tablespoons of raisins, stoned and cut fine, a few slices of citron, 2 salt spoons of cinnamon, 1 salt spoon each of clove and allspice, and 1 teaspoon of flour. (These proportions are for the individual rule).

This may be baked in thin sheets and put together in alternate layers with some of the plain cake baked in the same form, and the layers held together by a little jelly, or some white of egg, slightly beaten. Another variation may be made by baking some of the white cake in layers and making a chocolate or other filling for it. To one portion English walnuts may be added, to another dried currants, and to a third some sliced citron.

It is better to teach the cake lesson by giving one rule (any simple foundation may be substituted for the one given) and varying it, than by giving separate recipes; as this method makes the child see the unity underlying all the variations, and gives her the power to change her own rule if she chooses.

A second lesson may be given to gingerbread and cookies.

PASTRY

Pastry is not a form of food to be recommended, and should never be eaten by young children or by people of delicate digestion. The large amount of fat mixed with the flour and coating the starch grains, makes it difficult for the digestive juices to penetrate to the starch; and as fat is digested neither in the mouth nor the stomach, the starch is not acted upon until late in the process of digestion. If pastry is to be eaten, however, it should be light, flaky, and thoroughly cooked; and one lesson may well be devoted to its preparation. Puff paste is difficult to make and expen-

sive, and its preparation has no place in a public school course, but a plain paste may be given.

The principles of cookery involved in pastry making are those of starch cookery, and of the expansion of air to lighten the food materials.

The materials used are: —

1. Pastry flour. Since this contains more starch and less gluten than bread flour it makes a more tender paste.

2. Fat: either butter, beef dripping, lard, or sometimes cottolene. Lard makes a whiter pastry than butter, but pastry made with butter and beef dripping is considered more digestible.

3. Cold water. In summer ice-water is desirable. It is essential to good pastry that the fat should not melt until after the baking begins.

4. Salt, for flavor, and sometimes baking powder to aid in making the pastry light. The manipulations consist of rubbing in the butter with the tips of the fingers; stirring in the liquid with a knife; patting and lightly rolling the dough, and cutting it into shape for baking. The success of the work depends upon having everything cool, and upon the handling of the dough as quickly and lightly as possible. For the best pastry the butter must be washed and worked under water until waxy, to remove the salt and buttermilk. The utensils needed, in addition to those used for measuring and sifting, are a bowl, knife, kneading board and rolling pin, and plates or tins for baking. Pastry requires a hot oven, but the heat should be lessened after a short time. The pastry should first rise in the oven and then brown. The time of baking is from forty to fifty minutes.

Rule.

Plain Pastry. — 1 cup pastry flour, $\frac{1}{4}$ cup butter or 2 tablespoons butter and 2 tablespoons dripping, $\frac{1}{2}$ teaspoon salt, ice-water to moisten.

Individual Rule. — $\frac{1}{4}$ cup flour, 1 tablespoon butter, 1 salt spoon salt, ice-water.

Note. — If a very plain paste is desired, less fat may be used, and $\frac{1}{2}$ teaspoon baking powder to 1 cup of flour may be added.

Directions. — Sift together the flour, salt, and baking powder (if used). Wash the butter, and with the tips of the fingers work half of it into the flour. Add ice-water slowly, stirring with a knife, until a stiff dough is formed, then turn on a floured board and pat with the rolling pin, and roll lightly into an oblong piece. Spread the remaining butter upon the paste, and fold it, making three layers; pat and roll out and again fold into three layers, to entangle as much air as possible; roll out to about $\frac{1}{4}$ inch in thickness, and fit to the pie plate.

Apple Pie. — Select sour apples, pare, core, and cut into slices, and with them nearly fill the pie plate which has been lined with paste. Sprinkle with sugar, allowing 1 tablespoon to each apple, and with cinnamon. Lemon juice or nutmeg may be substituted for the cinnamon, and if a richer pie is desired, bits of butter may be dotted over the surface. Cover with a crust, and press together the edges of the two crusts which have been moistened with a little water. Perforate the upper crust with a large fork, or in some way, that the steam may escape. Bake for about three-quarters of an hour.

Custard Pie. — Line the plate with a crust and prick it with a fork. With narrow strips of paste, moistened with water, make a rim to the pie to add to its depth; bake until crisp but not brown. Mix milk, egg, and sugar in the proportion of 1 egg to 1 cup of milk and 2 tablespoons of sugar; season with a little salt and a few gratings of nutmeg, and pour into the crust. Bake in a moderate oven until the custard is set.

MARCH

THE BEDROOM

Advanced Course: Invalid Cooking

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CHAPTER XI

THE BEDROOM

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Introduction

The Word Bedroom. — It is unfortunate that the bedroom is not what its name implies — a place for a bed only. It too often contains not only conveniences for sleeping, but also for making the toilet. Not infrequently, especially in boarding-houses, one room must serve the purposes of bedroom, toilet room and living room. This condition of affairs is much to be deprecated, and we should always hold before ourselves the ideal of a bright and airy room, used only for a sleeping room. Into such a room none of the clothing worn during the day would be taken, and no toilets made. Bedrooms of this sort would make us a healthier people. They are not practicable for most of us, however, and the

statements made in this chapter must be understood as referring to a room used for both sleeping and toilet purposes.

Lesson I

Hygiene of the Bedroom

Necessity for Healthful Bedrooms. — In the bedroom one-third of life is spent. The other two-thirds is so divided that in most cases we may say there is no other one place in which so much of our time is passed. It follows that there is no other place which can be in so large a measure responsible for our health or for our sickness. The time spent in the bedroom, moreover, should be a time of refreshment and recuperation. If conditions are not favorable for these things, we are likely to be incapacitated for our daily work.

Substances which tend to make the Bedroom Unhealthful. — Much of the waste material of the body is cast off in the bedroom. This is in the form of excretions from the lungs, the skin, and the kidneys. These waste materials bear much the same relation to the body that the ash bears to the furnace. Most of them are not harmful in themselves, but they are useless, and they crowd out other substances which are distinctly useful. Another source of danger is the street dust which settles upon our clothing during the day. This is more likely to be left in the bedroom than in other rooms of the house because it is here that the clothing is put on and taken off, being thus moved about and shaken. This dust is dangerous, partly because it irritates the air passages, and partly because it is almost sure to contain the germs of disease.

Excretions from the Lungs. — Ordinary air is a mixture of two invisible gases, oxygen and nitrogen. About one-fifth

is oxygen and four-fifths nitrogen. Small amounts of other substances are always present. The nitrogen is very inert and neither affects the body nor is affected by it. The oxygen is the part of the air which is essential to life and health. Oxygen is frequently called the supporter of combustion. When a substance burns, it unites with oxygen and a compound is formed, which, while it contains both the substance itself and oxygen, is unlike either. Such a compound, called an oxide, will not burn because it has already all the oxygen it can hold. Neither is it a good supporter of combustion, because oxygen will not ordinarily leave the substance which holds it to unite with a new substance.

The oxygen in the air which enters our lungs is carried by the blood to the various tissues of the body. It there unites with the substances which compose the tissues. This phenomenon is called burning, and serves the double purpose of changing worn-out tissue into substances which can be easily removed from the body, and of maintaining animal heat. As the tissues are largely composed of carbon and hydrogen, the substances formed in the burning are chiefly oxides of carbon and of hydrogen. The former is a gas known as carbon dioxide. The latter is water. These are brought by the blood to the lungs and there excreted from the body. As they do not support combustion, it is useless to breathe them into the lungs. The process of breathing, therefore, carried on in a closed room, is constantly removing from the air a substance which is useful to the body, and returning to it substances which are useless. Worse than this, we are constantly breathing off minute particles of poisonous substances, probably bits of worn-out lung tissue. These substances are known as "crowd-poisoning," and give the bad odor to closed rooms in which many people are breathing.

It is evident, then, that in a bedroom, in which one remains so many hours out of the twenty-four, there should be a constant supply of fresh air. If fresh air is not supplied, the impure air is breathed over and over again, and both the carbon dioxide, which is useless, and the "crowd-poisoning," which is extremely harmful, constantly increase, while the useful oxygen diminishes. Nor is it safe to make one's senses the test of the purity of the air which he has for some time been breathing. It is easy to become accustomed to bad air. Who has not entered a close room, and found it difficult to breathe the air, whose impurity the occupants of the room had not discovered?

EXPERIMENTS. I. *To show that oxygen supports combustion.* — In a test-tube heat a few pieces of potassium chlorate until gas is given off. This gas is oxygen. Light a match. Extinguish all but a spark. Insert in gas at top of the tube. It bursts into a flame.

NOTE. — By consulting the works on chemistry given as references, the teacher can learn methods of preparing oxygen on a larger scale, and can show its properties more in detail.

II. *To make the oxide of carbon, known as carbon dioxide.* — Fasten a piece of charcoal, which is nearly pure carbon, on a wire. Pass the wire through a piece of cardboard. Heat the charcoal until it glows, and then plunge into a wide-mouthed bottle in such a way that the cardboard serves as a cover for the bottle. (A bottle of pure oxygen is better than a bottle of air). When the fire has gone out, remove the charcoal and pour clear lime water into the bottle. Cork and shake. The water will become milky. After the burning of the charcoal, the bottle was full of the gas called carbon dioxide. This gas always makes lime water milky.

III. *To show that carbon dioxide is not a good supporter of combustion.* — Make a bottle of carbon dioxide, as in Ex. II.

Into this plunge a lighted stick or taper. It is immediately extinguished.

IV. *To show that the air which comes from the lungs contains carbon dioxide.* — Take a bottle half full of clear lime water. Into this bottle fit a rubber stopper having two holes. Into one hole put a piece of glass tubing reaching almost to the bottom of the bottle. Into the other hole put a piece reaching just below the stopper. Placing the lips on the short tube, draw the air of the room through the lime water, being very careful not to exhale air from the lungs into the bottle. Note that the lime water undergoes very little change, if any. Now place the lips to the long tube and blow air from the lungs into the bottle. Note that the lime water soon becomes milky, and that on standing, a white precipitate settles to the bottom of the bottle.

V. *To show that heat is created within the body.* — Take the temperature of the room with a thermometer. Then hold the thermometer tightly in the hand for two or three minutes. Why does the mercury rise?

Lesson II

Hygiene of the Bedroom (continued)

Excretions from the Skin. — The waste material of the body is thrown off through the skin, as well as through the lungs. Every day there come through the skin small amounts of carbon dioxide, and from one and one-half to two pints of water. This water usually evaporates immediately, and is therefore spoken of as insensible perspiration. It is absorbed by the clothing, which, therefore, needs frequent washing or airing, to prevent it from getting musty. With the water always come certain solid substances which are left on the skin when the water evaporates. The skin also excretes an oily substance. Some of

these solid matters are ill-smelling when first excreted. Others decompose if they stay on the skin long. Butyric acid, which gives the vile odor to rancid butter, is found among the excretions of the skin. These substances are rubbed off from the skin by the friction of the clothing during the day, and when the clothing is removed at night they are likely to be freed, and to settle in the bedroom. They also get on the night clothing. The best way to keep these excreted substances from accumulating in the bedroom is to bathe frequently, and to air thoroughly the clothing worn at night as well as that worn by day.

Excretion from the Kidneys. — Urine, one of the waste products of the body, is often voided in the bedroom. This contains a substance known as urea, which arises from the decomposition of the nitrogenous tissues. The decomposition begun inside the body continues outside, and the urea changes into ammonia and carbon dioxide. These, passing into the air, add to its impurity. The urine also gives off small amounts of ill-smelling substances. These make us uncomfortable, if they harm us in no other way, and discomfort undermines the health, just as anxiety and sorrow do.

The Dangers from Dust. — Having considered the dangers from within, we must now give our attention to the dangers from without. The former have been understood for many years. The latter are only beginning to be understood. These dangers are due to the presence everywhere of very minute organisms known as bacteria. Bacteria are so small that the inexperienced find difficulty in seeing them even with the microscope. Like human beings, bacteria differ very much one from another. Some are very useful; for example, those which help plants to get food from the air. Others destroy property; for example, those which cause milk to sour. Still others are extremely harmful. Most of

the diseases with which people are afflicted are now thought to be caused by bacteria of the last class. The dust which blows about the street and which we carry into the house on our shoes and other clothing is full of bacteria, and these are frequently harmful bacteria. The bacillus of tuberculosis is very commonly found in street dust, on account of the frequency of the disease, and the failure of persons afflicted with it to exercise proper care in the disposal of the sputum. Surface dirt is very likely to contain the germ of lockjaw. Besides these two germs, those of many other dreaded diseases may be contained in the dust which clings to our clothing. For this reason we should be very careful not to bring overshoes and outside wraps into the bedroom. We should also be careful not to sit upon the bed or rub our clothing against it. It is well to remove the counterpane from the bed at night and substitute a sheet which has been put away from the dust. Woollen carpets and draperies provide good hiding-places for dust and germs. Such articles should never be used in a bedroom. On the other hand sunshine is a foe to germs, and should be allowed to stream into the bedroom all day if possible. Better fade all the furniture in the room than to give disease germs a chance to live and flourish. These three rules should always be kept in mind in combating the evils of dust: (1) Avoid, as far as possible, bringing harmful substances into the room. (2) Provide no lurking-places for such substances. (3) Remove frequently the harmful substances which inevitably do collect.

Suggestions for Illustrative Experiments. — I. The amount of matter excreted by the skin and lungs during the night may be determined by weighing one's self the last thing at night, and immediately on rising in the morning. If urine has been voided in the meantime, its weight must be subtracted from the total difference. If this could be done

by even one or two pupils in the class, it would serve as a valuable illustration.

II. Where a microscope is available, the teacher might, by the use of prepared slides, give her class some idea of the nature of germs.

Lesson III

Building and Furnishing

Location of the Bedroom. — The location of the bedroom is a matter for serious consideration. It should be so situated that it receives the sun during some time of the day. East rooms are preferable, for they get the sun during the morning airing and cleaning time. Next best are south rooms. All rooms cannot be east or south rooms, but a house can be planned so as to get sun into most of the rooms. As important as sun is fresh air. If it is impossible to have opposite windows in the bedroom, the house should be so planned that the windows of each bedroom are opposite to windows in an adjoining room or hall. It will then be possible to allow the fresh air to sweep through the rooms as often as needed. There should always be a window in the bedroom closet. This should be in the wall opposite the door of the closet, thus securing a draft when the door and window are opened for the daily airing. Quiet is another important consideration in locating the bedroom. Other things being equal, the bedroom should be in the part of the house most removed from the noise of the street. A little additional care in building, in the direction of deadening partitions and floors, would serve to keep from the bedroom many of the disturbing sounds within the house.

It is a great advantage if, in planning the house, a place can be provided for airing mattresses. Because of the weight of the mattresses it should not be necessary to

carry them far. A sunny porch, out of sight of the street, and opening by a door or a long window from the upper hall, is the best place for such airing. This porch should be furnished with hooks for attaching clothes lines. On the lines, pillows and the lighter weight bed furnishings can be aired.

Finishings of the Bedroom. — Having located the bedroom, attention must next be given to the finishing. In covering the walls, the first consideration should be that of cleanliness. If paper is used, it should be frequently renewed. Paint is desirable because it can be washed. Calcimining is cheap and easily renewed. The woodwork should be plain, and so made as to shed dust instead of collecting it. Closet shelves should be removable. If there is a chest of drawers in the closet, it should stand well up from the floor, so that the space underneath can be easily cleaned without removing the drawers. The floor should be so made as to look well without a covering. Hard wood is best, but soft wood painted is better than the costliest carpet.

The Furniture of the Bedroom. — The necessary furniture of a bedroom consists of a bed, a dresser, a washstand, a towel rack, a table, and a few chairs. A screen and a clothes rack for airing clothing and bedding are desirable. All of these should be of light weight, and should stand high from the floor.

The Bed. — If it is necessary for two persons to occupy the same room, each should have a separate bed. The best beds are those of brass or iron. The simplicity with which these beds are constructed makes it possible to keep them almost dust-free, while the metal furnishes a cold welcome to the bedroom pest, which the most careful housekeeping cannot, in these days of public conveyances, prevent from occasionally making its way into the house. The brass beds are generally considered the more beautiful, but, be-

sides being more expensive, they require more care to keep them bright, and are no more healthful than the iron ones. The bed should have a woven wire spring, attached to an iron frame in order that it may not sag. This spring should be provided with a coarse cotton cover for top and sides, to which should be attached tapes for keeping it in place. Over the spring should come the mattress. The kind of mattress used is a matter of personal choice. Hair mattresses are, in many respects, the most desirable. An objection to them, however, is that they are too yielding, and do not support the body in the horizontal position most conducive to healthful rest. An excellent combination may be made by placing a thin hair or wool mattress over one of harder material. It is best to have the heavier mattress, at least, made in two parts for ease in turning. The mattress should be encased in a cotton cloth to protect the tick. Such a case should be washed two or three times a year. The cleanliness of the bed depends much on the size of the sheets. These should be three-quarters of a yard longer than the mattress, and as much wider. Blankets are better than comforters, because they are more easily washed. All-wool blankets are more beautiful, but are harder to wash and are no more healthful than those which are part cotton. The counterpane should be of generous size and of some washable material. Pillows should have removable cases of white cloth over the tick, besides the pillow-slips.

Furnishings of the Dressing-table. — The dressing-table should have a cover that can be easily laundered. Nothing is more unlovely or more unhealthful than silk, velvet, or woollen furnishings for a dressing-table. The hair receiver, trays, and any other article forming part of the equipment should be of metal or china. The latter is better, because more easily cleaned.

Furnishings of the Washstand. — The washstand should

be protected by a washable cover. The wall back of the stand may be painted to match the decoration of the rest of the room, or may be protected by a screen or cloth. The pieces composing the toilet set should be of generous size, the bowl broad and shallow, and the pitcher wide-mouthed.

Rugs and Draperies. — Upholstered furniture and woollen draperies should never find their way into the bedroom. A few rugs that can be easily shaken are not so inadmissible. Wool, however, is the best kind of a lurking-place for bad odors, dust, and bacteria. If the walls of the bedroom are of delicate color, the draperies and bed furnishings dainty, the room can be made most attractive without a single article in it which cannot be easily cleaned.

Exercise. — If the class is composed of sufficiently advanced pupils, the principles of this lesson can best be impressed upon them by having them plan the upper floor of a house, endeavoring to secure for each bedroom a maximum of sunlight and air. Each pupil could be required, also, to prepare a scheme for decorating and furnishing a bedroom.

Lesson IV

Going to Bed, and leaving the Room in the Morning

Relation of Personal Habits to Healthfulness of the Bedroom. — If we keep in mind the facts given in Lessons I. and II., we can easily realize that our personal habits may determine the healthfulness or unhealthfulness of the bedroom. Remembering that outside wraps and overshoes have street dust and bacteria upon them, we should leave such articles in hall closets, and not bring them into the bedroom. All clothing should as often as possible be shaken and brushed in the open air. In preparing for bed, we should never put into the closet articles of clothing which have been next to

the skin during the day. These should be aired by an open window. A small rack which can be folded and laid away during the day is convenient for this purpose. It can be used also for the airing of bedclothes in the morning. The excretions of the skin should be removed at least once a day with water, and not be left to accumulate in the bedroom. People differ as to the time of the daily bath; but the hands, face, and feet, which are most likely to have germ-laden dust on them, should be washed at night, even when the time for the whole bath is the morning. Although these matters come more appropriately under the head of personal hygiene, they are introduced here because of the close dependence of the cleanliness of the bedroom upon the cleanliness of the person.

Preparation for the Night. — In preparing the bed for the night, the counterpane should be removed and carefully folded. For the protection of the blanket, a sheet or other light covering may be put over the bed. Be sure that the sheets thoroughly protect the blankets from contact with any part of the body. The windows should always be opened at night. If one objects to dampness in the air, a screen such as is described in Lesson VI. may be placed in the window. The ventilation of the room will be fairly satisfactory if the window is opened only from the bottom, providing it is opened wide; but, as the warm air from the body rises, it is better to have the window open at both top and bottom. If the shade is left part way down, this will generally cause it to rattle and disturb the slumber. To avoid this, roll the shade to the top, and have a large screen to protect the person in bed from both light and draft.

Care of the Room on Rising. — On rising, we should at once take measures for ridding the room of the excreta which have been given off from the body during the night. The bedclothes should be removed from the bed and hung on

chairs or a rack by an open and, if possible, sunny window. The mattress should be turned daily, and the bed frequently rolled out before a sunny window. If occasionally left here all day, no harm, but rather good, will result; and no one will object except that class of housekeepers whose zeal for having the "room-work done up early" leads them to shut all sorts of impurities away from the cleansing power of sun and air. The night-dress should be thoroughly aired before being put into the closet. If one does her own room-work and must leave the house soon after breakfast, she should clean the washstand before breakfast in order to have the room left open as long as possible after the air has been freed from the pollution of odors arising from the slop jar and chamber. If time is not limited, this can be left until after breakfast.

Exercise. — This lesson may easily be made a practical exercise, if a model bedroom is provided. Pupils can go through the preparations for retiring and for leaving the room in the morning, explaining each act in accordance with the principles of Lessons I. and II.

Lesson V

The Daily and Weekly Cleaning of the Bedroom

The Daily Cleaning. — The bedroom should be aired during the breakfast time, according to the directions given in the last lesson. Unless the weather is very cold, the windows should be left open while the cleaning is being done.

Cleaning the Washstand. — Examine the soap-dish. If it is dirty, wash it in the bowl and dry on a cloth kept for the purpose. Wash and wipe the bowl thoroughly. Take the slop jar and the chamber to the bathroom. Empty them, rinse with cold water, and wipe them dry. If, because there is no bathroom in the house, or it is not easily accessi-

ble, a pail must be brought into the bedroom, set it on a cloth kept for that purpose. After emptying the contents of the jar and chamber, rinse them with water from the pitcher, drying as before. The pitcher should next be filled, after having been rinsed to free it from probable settlings. Remove the soiled towels and place clean ones on the rack.

Making the Bed. — The bedding having been thoroughly aired and the mattress turned, the bed is ready for making. Put on the under sheet, tucking it in securely under the mattress at top, bottom, and sides. Put on the upper sheet and blankets. Tuck them in at the foot, but allow them to fall at the sides of the mattress. Turn the upper sheet down over the blankets. Put on the counterpane and pillows, beating and smoothing the latter well.

General Care. — Brush the dust from the floor. Dust all furniture with a soft cloth. Arrange the articles on the dresser and table. It is always well to wipe up the floor with a damp cloth after the dusting has been done. If it is impossible to do this daily, let it be done as often at least as two or three times a week.

The Weekly Cleaning. — If convenient, and the day is suitable, remove the mattresses to a sunny porch, and leave them while the room is being swept. If the room contains rugs and any unwashable draperies, remove them to some outdoor place where they can be properly beaten and cleaned. Brush the floor of the closet, and wipe with a wet cloth, drying thoroughly. Wash the toilet articles with soap and water, and place them on the floor of the closet. Remove the cover from the washstand. Put it into the wash, or, if it is not soiled, shake it thoroughly by the open window, and put it into the closet. Dust all articles on the dressing-table, and any small ornaments, and put them away in a drawer. Brush the dust from the pictures, the furniture, and the

woodwork. Then brush the floor. Allow the dust to settle, and, in the meantime, clean the looking-glass and the windows. Next dust the room thoroughly with a soft cloth. Wipe the floor with a damp cloth, and replace the furniture. It is well occasionally to wipe the ceiling and wall with a cloth tied over a broom, or with a long-handled brush made for the purpose. If the room is carpeted, the method of cleaning is much the same, but in this case there is so much more dust that light furniture should be removed from the room and heavy furniture covered with cloths. The carpet should be wiped the last thing with weak ammonia water.

Exercise. — The methods of cleaning described in this lesson can be illustrated in the model bedroom. In addition to the furniture of the room, there should be provided a large floor-brush, a ceiling-brush, a whisk broom, a pail, soap, and a plentiful supply of soft rags and dusting cloths.

Lesson VI

The Care of the Sick

Need of Healthful Conditions in the Sick-room. — Especial care should be taken to have the conditions of the sick-room healthful. Here the invalid spends, not merely one-third of his time, but all of it. On account of his weakness, he is unable to resist harmful influences. The amount of waste material thrown off from the body is generally much increased, as is shown by the wasting of the body. What we have learned in regard to the care of bedrooms in general we may apply to the care of a sick-room, keeping in mind always the need of extra precautions in ventilating, cleaning, and in other ways preventing the accumulation of harmful substances.

Ventilation. — In order that the air of the room may be kept fresh, make a screen for the window, having a frame like that of an ordinary wire screen. Over the frame tack a piece of flannel. This screen, placed in an open window, admits fresh air, but excludes dampness. At night, never turn the light low, for the gas or oil is likely to escape unburned, thus polluting the air. In order that the patient may not be disturbed by the bright light, have a small paper screen to hang between him and the light, or have a large screen to shut off the light wholly from the bed. With these precautions, the air can be kept reasonably good for several hours. The room must, however, have a thorough airing at least once a day. This may be done without injury to the patient, if these directions are followed: put a small, light, perfectly clean shawl around the patient's head, and pin it under his chin; one end thrown lightly over his face will furnish further protection, if needed; put an extra blanket on the bed; double a sheet lengthwise, and put it on the side of the bed toward the window, fastening it to the head and the foot of the bed, and having it come high enough to shield the bed completely; open all the windows, and leave them open for half an hour at least.

Care of the Bed. — The care of the bed is extremely important, not only for the comfort of the patient, but for his safety. The sheets should be changed at least once a day. Unless a patient is suffering from some contagious disease, the sheets which are removed can usually be cleansed sufficiently by sunlight and fresh air to permit of their being used again. In the morning, remove both sheets, or, at least, the under one, which receives more of the bodily excreta than the upper one. Hang this sheet in the open air, in the sun, if possible. Take it in at night, and have it thoroughly dry and warm for use the next morning. Much of the labor of washing may, in this way, be saved, without endangering

the comfort or safety of the patient. Whether one or both sheets are to be changed, and whether the change shall be made only in the morning, or both in the morning and at night, as well as the frequency of washing, will depend upon the severity of the sickness. A sheet folded twice and stretched across the bed under the patient's body is a great protection to the under sheet, and is easier to change. It is necessary, however, to pin it down very carefully with safety pins, or it will prove an uncomfortable addition.

Changing the Sheets. — In order to change the sheets without disturbing the patient unnecessarily, remove the sheet from half of the bed, and replace it with a clean one. Push the soiled sheet up toward the patient, and also the clean sheet. The patient can then move, or be moved, on to the clean sheet, and the other side of the bed covered with it. Fasten the sheet securely to the mattress with large safety pins; this prevents the possibility of wrinkling. The lower sheet should be particularly well tucked in at the top. If the sheet is short, sacrifice the foot rather than the head. In putting on the upper sheet, this must be reversed. Tuck in well at the foot, and, if necessary, protect the counterpane with a large handkerchief.

Changing the Nightclothes. — In putting a night garment on a helpless patient, gather the back of it into loose folds from top to bottom. Holding these in the right hand, with the left raise the patient's head, and slip the garment over it, the folded part coming under his neck. Put the arms of the patient into the sleeves, and gently draw down the garment. In removing, reverse the process. Pull the garment up into folds under the neck. Remove the arms from the sleeves; raise the head with one hand, and take off the garment with the other.

Bathing the Patient. — For the bath, there should be, at the bedside, a blanket, a basin of water from 90° to 100° F.,

a Turkish towel, a face towel, a washrag, and a piece of pure soap. Floating soaps are best for this purpose. Remove all of the patient's clothes; put him in a blanket, and cover him. Put the face towel under his head. Wash his face, neck, and ears, using no soap upon the face. Dry well with the face towel. Put this towel away. Lay one arm on the bath towel; wash and dry. Repeat with the other. In the same way, wash one leg at a time. Finally, bathe the chest and back. Rub the back with alcohol to harden the skin and prevent bed-sores. Put on the patient's night-clothes, and remove the blanket.

Combing the Hair. — If the hair is long, it should be parted through the middle, and each side divided into two parts. The front hair on each side should be braided for a little distance; then this part should be drawn back, and braided in with the back section on the same side.

Giving the Medicines. — Medicines should be kept out of sight of the patient. Glasses, spoons, a napkin, and anything else needed in administering the medicines, should be kept on a little tray, on which is a dainty doily. The glasses and spoons should be kept bright and shining. In giving medicine, put a napkin under the patient's chin, and have the medicine in a glass, instead of bringing the bottle to the bedside.

Sanitary Precautions. — The floor of a sick-room should be wiped every day with water. The furniture should be kept free from dust, all unnecessary articles, and those especially likely to harbor dust, being removed from the room. Everything used about the patient, or in the room, should be spotlessly clean. Disinfectants may be dispensed with in non-contagious diseases, but soap must never be spared. The chamber should be kept in the closet. It should be provided with a sanitary rubber cover, which prevents the escape of odors, and is of light weight, and noiseless. This

cover may be used also on the bedpan. A little water should always be poured into a chamber or bedpan before it is used, thus facilitating its cleaning. These articles should always be washed with soap after being used by the sick.

Care of Flowers. — Flowers should never be kept in a sick-room after they begin to fade. The stems should be cut every morning, the vases thoroughly washed, and the flowers put into fresh water. At night they should be removed from the room to a cool place.

Exercises. — This lesson is especially well suited to practical illustration. The directions given for changing and securing the sheets, for changing the nightclothes, and for bathing the patient, will serve as a guide for three highly practical and useful demonstrations.

Lesson VII

Feeding the Sick

Duty of the Nurse. — The feeding of the sick is a very important matter. In acute diseases, proper food is as necessary as medicine; while, in many chronic diseases, diet may be the only means of cure. In ordering and preparing food for the sick, the physician and nurse have each distinct duties. It is for the physician to determine what the patient should eat, and for the nurse to follow his orders intelligently. If these orders are very explicit, the nurse needs only a knowledge of the principles of cooking; but if they are indefinite, — if, for example, he orders a liquid diet, without specifying what foods are included under such a designation, — the nurse has need of some knowledge of the principles of invalid feeding.

Liquid Diet, or Food for very Sick Patients. — A very sick patient may have more need of nourishment than a well person. An acute disease is usually accompanied by fever.

Fever indicates that the tissues are being rapidly burned out and destroyed. This creates a need of food with which to replace these lost tissues. Unfortunately, just at the time when the need of food is greatest, the digestive apparatus is likely to be out of order. It is the duty of the digestive organs to make insoluble foods soluble, and thus ready to be carried to the different parts of the body. This they can do in health. In sickness, however, their work, in part at least, must be done for them. Hence the very sick should, as a rule, be given only soluble foods. These may be naturally soluble, like albumen and sugar, or they may have been predigested. It is frequently necessary to have the food not only soluble, but also very dilute. In this form it is most easily absorbed. The large amount of water in dilute foods is valuable for the washing out from the system of the waste material which results from the excessive destruction of tissues. The sick, like the well, need proteids for building tissues, and also carbohydrates or fats for giving heat and energy. The first is best given to the very sick in the form of albumen, which is soluble in water, or of digested proteids, which are known as peptones. The first is found in meat juices, uncontaminated by indigestible substances, and accompanied by certain mild stimulants. White of egg is an almost pure solution of albumen, but is not very dilute. Milk whey contains a little albumen. Peptonized foods can be prepared at home, or bought ready prepared. The heat-producing foods are usually given in the form of soluble carbohydrates. One of these is dextrin, made by the action of heat on starch. It is found in the brown crust of bread or of toast. This can be dissolved, and served as "toast tea." This familiar article of invalid diet is now being superseded by the malted foods which are everywhere on sale. These contain dextrin and other soluble carbohydrates. The sugars are also

soluble carbohydrates. As all starch is converted by the healthy body into grape sugar, before it is absorbed, this form of sugar is probably most easily digested. Starch should be given only when thoroughly cooked, and very dilute, as in gruels. Fats are never soluble. They are most digestible if emulsified, *i.e.* divided into tiny globules. Milk contains emulsified fat. Milk is usually included in a liquid diet. It contains albumen, sugar, and emulsified fat. It contains also, however, casein, which becomes solid in the stomach. This constitutes its chief fault for food for the very sick. If lime water be added to the milk, the curd formed in the stomach is not so large. Fruit juices are refreshing. While not themselves nourishing, the sugar, with which they are usually served, is so. They make a pleasing variety in the invalid's food, especially when served frozen.

Semi-solid Food, or Food for Convalescents and Patients whose Digestion is not seriously Disturbed. — We should bear in mind that the very dilute foods are given because the digestion is impaired, and not because the patient does not need more nourishment. The moment he can digest more nourishing food, he should have it. When the doctor thinks the patient is able to digest it, he orders a semi-solid diet. This consists of the articles included under liquid food, and also of scraped meat, raw or soft-boiled eggs, egg-nog, egg lemonade, soups, milk toast, soft custards, and gelatine preparations. Meats, unless scraped, vegetables, fried foods, and pastry should never be given.

Full Diet. — When a patient is put upon full diet, the only duty of the nurse is to prepare attractive and palatable food. She is under no limitations except that of excluding notoriously indigestible dishes, such as fried eggs and fat-soaked foods.

Serving Food. — In preparing food for a sick person, re-

member that it should be served in the most attractive way possible. Beautiful dishes, a small vase of flowers, and dainty garnishings for food may be the means of making a person take food which he would otherwise reject. If the invalid is able to feed himself, the food should be served on a light tray, in light dishes so placed as to be easily reached. All hot food should be served hot. As it usually must be carried some distance before being served, it should be carefully covered. Cold foods should be served really cold. Variety in foods, and especially in flavoring, is often essential. Serve to the patient in courses if there are several dishes, and do not leave soiled dishes in the patient's room. The patient's mouth should be rinsed with a dilute solution of listerine after every meal.

Exercise. — Each pupil should prepare a bill of fare, for one day, for a person on liquid diet, for one on semi-solid diet, and for one on full diet. Another useful exercise is the preparation of a tray for serving food to an invalid.

Lesson VIII

Recipes for Invalid Cookery

(See also the last section in the chapter on Starchy Foods)

Barley Water. — 4 tablespoons pearl barley, 1 quart water, sugar, lemon juice, lemon rind and salt to taste. Wash the barley thoroughly and soak in water for several hours; boil for an hour; season; strain; reheat before serving.

Toast Water. — Stale bread, boiling water. Heat the bread in the oven until it is brown and crisp; break into pieces; pour over it an equal volume of boiling water; strain; season with salt. Reheat before serving.

Egg-nog. — Yolk of 1 egg, $\frac{3}{4}$ cup milk, 1 tablespoon sugar, 2 tablespoons wine, 1 tablespoon lime water, speck of salt, white of 1 egg. Beat the yolk of the egg; add milk, sugar, wine, lime water, and salt; strain; add white of egg beaten stiff.

Albumenized Milk. — To the stiffly beaten white of an egg add one-half a cup of milk. Stir thoroughly or cover and shake.

Egg Lemonade. — To a glass of lemonade add a well beaten egg or the beaten white alone and two tablespoons of whipped cream.

Wine Whey. — Mix equal parts of scalded milk and sherry wine. When the curd forms, strain.

Beef Essence. — Free one pound of round of beef from fat and bone; cut into small pieces; put into a Mason jar; add a pint of cold water, allow to stand for one-half an hour; put into a pan of water and heat gradually to 130° F; keep at about that temperature for three hours; or, instead of heating, add a few drops of dilute hydrochloric acid, and allow to stand for an hour, stirring occasionally; strain, season with salt.

Beef Juice. — Broil a piece of beef until the juice begins to flow, turning it frequently; cut into small pieces; extract the juice with a hot potato ricer, and allow to run into a hot glass; season with salt.

Flour Gruel. — 1 tablespoon flour, 2 cups milk, salt to taste. Scald most of the milk in a double boiler; thicken with the flour moistened with the rest of the milk. Cook forty minutes.

Scraped Meat. — Cut round of beef into thin strips; scrape with a sharp knife to free the fibre from the connective tissue; season the fibre with salt, and spread between thin slices of bread, or make into balls and cook slightly. The cooking can best be accomplished by putting the balls into a

hot ungreased frying pan, and shaking them to keep them from sticking..

Junket. — 1 cup milk, 2 tablespoons sugar, 1 tablespoon wine, $1\frac{1}{2}$ teaspoons liquid rennet. Dissolve sugar in wine; heat milk to about 120° F; add wine and rennet; stand in a warm place until it forms; chill; serve with cream and sugar.

APRIL

THE LAUNDRY

I. Preliminary Course
II. Advanced Course

By MARY B. VAIL

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CHAPTER XII

THE LAUNDRY

BY MARY B. VAIL

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Facts.

I. EQUIPMENT FOR LAUNDRY (*for class of eight*). — 12 small fibre or wooden tubs, 1 large fibre or wooden tub, 8 small rubbing boards, 1 wringer on large tub, 2 small wringers, 1 fibre or tin pail, 1 tin dipper, 1 clothes basket, 1 clothes stick, 1 medium sized copper-bottom boiler, 6 long

benches for the tubs, 8 small skirt boards ($3\frac{1}{2}$ to 4 ft. long), 8 covers for kitchen table (blankets and unbleached muslin), 2 clothes horses, 1 fringe brush, 3 soft brushes for flannel, 3 whisk brooms for sprinkling; flat irons, 4 seven pound irons, 8 four pound irons, 8 five pound irons, 4 three pound irons, 8 Troy polishers; 10 yds. cheese cloth, 3 roller hand towels, holders, wax, paper, old cloth, toilet pins, safety pins, tape; 1 granite soap cooker, 1 granite starch cooker, 1 teakettle, 1 dishpan, 3 large bowls (2 qt., 4 qt., 6 qt.), 8 small bowls (1 pt.), 2 tin measuring cups (for thirds and fourths), 6 tablespoons, 6 teaspoons, drying closet inside or posts, line and clothes pins for outside; laundry stove; if tubs are stationary, have not less than nine with hot and cold water connections; stools should be supplied for short girls either for washing or ironing.

II. Study of Materials. — Water, the chemist tells us, is a combination of hydrogen two parts and oxygen one part. We know it as the transparent, almost tasteless, liquid which falls from the clouds and is collected in lakes, rivers, cisterns, and wells for us. Sometimes we find it soft, as rain or river water, but if it has flowed over limestone it is hard water. When water falls as rain, it catches some of the air and the gases, especially carbon dioxide. This gas has the property of combining with lime and forming a soluble salt which in the water makes it hard. We know by the feeling of the water if it is soft or hard, also when we use soap in it. Soft water lathers at once, but hard water does not until all the lime in it has combined with the soap to form that curd or lime soap that you see on top of the water. The simplest way to soften water is by boiling, then the lime and gas separate, the gas goes off and the lime falls to the bottom. A familiar example is the lime or fur in the teakettle. Our grandmothers used wood ashes to soften hard water; to-day we use the active principle of the ashes — lye or sal-soda — for

the same purpose. These strong alkalies must be used with the greatest caution or the clothes will be injured. The milder alkalies, ammonia and borax, may be used without fear of harm but they are expensive. For best results we need soft water in the laundry, so hard water must be softened in some way.

Soap is a combination of a fatty acid and an alkali. If well made, it has little more than a trace of fat or alkali left over. Strong or laundry soaps always have an excess of alkali in them. Soap powders have a large amount of alkali in them, and liquid preparations are alkalies in solution and water. The effect on the hands will tell you the nature of these compounds. The alkali takes up the oil in the skin and eats the skin as well as the dirt and the fabric. Soap decomposes in water, the alkali takes hold upon the oily dirt, while the fatty acid forms an emulsion and gives the water that milky look.

Bluing is supposed to make the clothes white in lieu of sun and air. When clothes become yellow from careless washing and rinsing and we haven't a grass plot to bleach them in, we resort to bluing to overcome the yellow color. The first bluing used was indigo, a vegetable product. Now ultramarine blue is more commonly used. It comes to us in little blue balls, blocks, or powder. This ultramarine was originally the stone lapis lazuli ground up, but it is now made chemically. Both indigo and ultramarine are insoluble blues. The fine particles are held in suspension in the water and settling on the cloth give it the desired tint. Prussian blue comes as a liquid and gives us a bright blue. It is a salt of iron. With heat and a strong alkali it is changed to another salt of iron commonly known as iron rust. If clothes are well rinsed, no ill effect should follow its use. Perhaps to its careless use are due the fine rust spots that sometimes appear. Aniline blue is rarely used

outside of the public laundry. It is a strong dye that will not set in an alkaline medium, hence thorough rinsing is necessary. The laundries usually neutralize any alkali with an acid before using the aniline blue. If the acid is too strong, the strength of the material is impaired.

Starch is found in all vegetables in some stage of their growth. It is the food stored for the use of the young plant, and is abundant in the seeds and tubers, but may also be found in the leaves and stalks. Under the microscope starch is a grain varying in size and shape according to the plant from which it is taken. Being the stored food for the young plant, starch is in its most compact form, lacking water. This it readily absorbs, especially near the boiling point of water, and during this absorption or hydration it often increases to twenty times its volume. Raw starch is a glistening white powder insoluble in cold water, but more nearly soluble in boiling water. Its stiffening power makes starch useful in the laundry. Corn starch is most commonly used for laundry purposes, next wheat, then potato, and rice starch is used for fine work.

Wax, the product of the bees, seems to fill up the iron and make it run smooth.

III. Rules and Recipes. — Soap solution is a most convenient way of using soap. To one small bar of white soap shaven fine, allow 2 quarts of water, let it boil until the soap is dissolved, use while hot. A cake of common yellow laundry soap shaven would require 3 or 4 quarts of water.

Thin starch. In the granite pan put $\frac{3}{4}$ cup starch, and $\frac{1}{3}$ of level teaspoonful of lard, stir smooth with $\frac{1}{2}$ cupful of cold water, add gradually 3 pints of boiling water, stirring constantly. Let it boil well, then add 1 pint of cold water to thin and cool it. If it is still too thick, it may be further reduced. This starch will be right for ordinary uses.

Thick starch is used for collars, cuffs, shirt waists, and shirt work. Make $\frac{1}{2}$ cupful of starch smooth with $\frac{1}{4}$ cupful of cold water, add $\frac{1}{4}$ of a level teaspoonful of shaven white paraffin and 4 cupfuls of boiling water. Let this boil up several times and add a little bluing.

Clear starch for fine muslins may be made, using one level tablespoonful of starch to one quart of water, let it boil well. Rice starch is preferred for fine work. The water off of cooked rice may be used, or the starch may be made in the following manner. Wash 2 tablespoonfuls of rice, put it in a saucepan with 1 quart of water and place it on the back of the stove where it will not burn or boil over. Stir it frequently at first, and let it cook until the rice is a pulp, then strain it through a flannel bag without squeezing. Dilute with cold water if necessary, and use it warm.

Raw starch is often used instead of thick starch for collars, cuffs, etc. Make one tablespoonful of starch smooth with a little water, then add the balance of a pint of warm water. Use at once; if it stands and settles, stir it well before using again.

Bran water may be used for delicate colors when soap would affect them. Tie $\frac{1}{2}$ pound of bran in a cloth, and pour over it 2 quarts of boiling water; when it cools, use it as you would suds.

Taking out Stains. — Fruit stains, if fresh, will come out with boiling water. Stretch the stained part over a bowl, and pour absolutely boiling water through it from a height until the stain disappears.

Coffee stains, if fresh, will yield to the same treatment as fruit stains.

Tea and cocoa stains are hard to remove. Soak them in cold water and borax before using boiling water as for fruit stains.

Blood stains should be first soaked in clear cold water, then use soap and water.

Milk stains should be washed out while fresh in cold water.

Mildew, if not too old, may be removed. Apply soft soap and powdered chalk to the spot. Keep it moist, and lay it in the sun.

Ink stains may come out if they are soaked in milk for a day or two; allowing the milk to sour on the goods rather helps than hinders the process; but if the material is colored, it may also take out the color.

The use of an acid for removing stains when other agents fail is not advised, for it attacks not only the stains but the fabric itself. If you wish to try an acid, proceed as follows: Fill a bowl with boiling water, over it stretch the stained part. Drop upon the stain a very little dilute hydrochloric acid, using a medicine dropper. Occasionally dip the stain into the water, then continue applying the acid until the stain disappears. Always have a second bowl containing ammonia and water to rinse the article in so that the acid may be perfectly neutralized.

IV. Washing clothes is necessary from the points of comfort, appearance, and health, both personal and public. Dirt is largely of an oily nature. The alkali of the soap combines with the dirt to form a soapy compound which is soluble, and is carried away in the water. Water is a great dirt carrier, and should be used in abundance for washing clothes. Soft water is preferred; hard water may be softened by boiling, by the judicious use of sal soda in solution, or by the use of a strong soap. Soaking clothes in soapy water for an hour or more before washing makes the work lighter. Never wash a tubful of clothes in the water in which they have been soaked. Wring them out into a clean suds, and with the rubbing board or the hands loosen the

dirt. If all the dirt is not removed by the rubbing, put a little soap on to the soiled part before dropping it into the boiler. Have cold water and soap in the boiler, let the water heat and boil from ten to twenty minutes. The longer time is necessary for clothes from a sick-room, for disease germs are killed by boiling. Have ready warm, clean rinsing water; have it warm because cold water would harden the soapy dirt on to the clothes, and necessitate rubbing to remove it. Rinse the clothes in several waters, or until the water is clear. A generous supply of water is very essential, especially in rinsing to carry off all the dirt, and leaves the clothes white and clean. Make bluing in a small utensil and pour it into a tub of water until the water seems sky blue when taken in the hand. Solid blue must be tied in a flannel bag and squeezed out of it into the water. The bluing water must be used at once, not be allowed to stand and settle. Stir up the water well that the color may be even, shake out the articles to be blued, and put them into the water a few at a time. Wring them out at once, shake them and hang them to dry in the shape you wish them to be in when worn. A little work here will make ironing much easier. When dry, fold clothes, don't crush them into a basket. For sprinkling have a clean table, a bowl of tepid water, and a whisk broom, or use the tips of the fingers, to distribute the water in fine drops all over the garment. Fold and roll the article tightly, and cover it for several hours before ironing.

V. Ironing is done for comfort and appearance, and is a very important part of the work. The table or board should be of convenient height for the ironer. It should be covered first with one or two thicknesses of heavy flannel or blanket. Felt may be procured of the laundry supply people. This should be tacked on to the boards. Over this should be tied, or pinned firm, fine unbleached muslin. On the table at the

right of each ironer should be found a clean paper folded several times, also a piece of old cloth or cheese cloth, both to try and clean the iron on, also a bit of beeswax tied in a cloth, and an iron stand. When the iron is hot the wax may be rubbed lightly over it and then the iron rubbed on the paper to make it smooth. With these aids the iron should always be clean and cool enough not to scorch before it touches sheet or garment. First iron trimming, ruffles, and the parts that will muss least, then take the plainer parts of the piece. Fold garments and all pieces first lengthwise into a long strip, then crosswise, and hang them to air on a clothes horse, and let them remain until perfectly dry. If garments are not ironed dry and aired they will easily muss. If put away damp they may mildew, and if worn or put upon a bed may cause sickness. Embroidery must be ironed wrong side up over several thicknesses of flannel to bring out the design. To test irons for heat, touch them with a moist finger: if they hiss, they are hot; if the sound is a short one, they are probably too hot. The laundress determines the heat by holding the face of the iron about four inches from her cheek for a few seconds: if too hot for comfort, it is too hot to use.

VI. Care of Laundry and Utensils. — All utensils must be washed and wiped and left clean and dry after washing. The floor must be wiped up and everything left in order. Fibre tubs must be washed and wiped, wooden tubs in addition to this must be left with water standing in them to prevent their warping and leaking. The wringer must be wiped off, and the screws that hold the rollers together loosened. Occasionally the rubber rollers may be rubbed over with a few drops of kerosene on a cloth, to clean them. Kerosene eats rubber, so use it sparingly. Irons must be kept in a dry place, and always put away clean. Scrape the starch off with an old knife. A little fine salt

or scouring brick on a paper will scour them when they need it. Rub the iron over the paper. When irons are put away for some time, rub them over with mutton tallow or vaseline, and wrap them separately in paper. All tinware must be thoroughly dried after washing, to prevent rusting.

Experiments with Bluing. — Fill a test-tube half full of Prussian or aniline blue in solution, using it dilute, add a quarter of a teaspoonful of strong solution of sal soda, and heat to boiling point. The Prussian blue should change to the yellow brown salt of iron, rust. The aniline should lose its intense blue; and ultramarine blue, if treated in the same way, will resolve itself into a white flocculent precipitate.

OUTLINE: COURSE I

Eight Fundamental Lessons

Each of these lessons presupposes a two-hour period. If only one hour can be devoted to this work, take the theory for one lesson, and the practice for another.

Children may bring their own clothes for practice work.

LESSON

I. Introduction.
   Talk on necessity of cleanliness.
   Talk on water, soap, and alkalies, with experiments.
   Washing bed linen.

II. Talk on bluings.
   Taking out stains; demonstration.
   Washing table linen.
   Ironing bed linen.

III. Talk on starch.
   Make starch; demonstration.
   Washing body linen.
   Ironing table linen.

LESSON

IV. Making starch; class work.
Washing body linen: night-dress.
Ironing body linen: waist or drawers.

V. Talk on dyed goods.
Washing colored apron and stockings.
Ironing night-dress and stockings.

VI. Talk on clear starching.
Making thin starch.
Washing white apron and handkerchiefs.
Air drying and ironing apron.
Ironing colored apron and handkerchiefs.

VII. Talk on wool fibre and shrinking of wool.
Washing woollen underwear.

VIII. Talk on silk.
Washing silk handkerchiefs and ribbons.

OUTLINE: COURSE II

Eight Supplementary Lessons

I. Making starch.
Washing underskirt.

II. Washing small gingham dress and shirt waist.
Making starch.
Ironing underskirt.

III. Making thick starch.
Rubbing starch into parts of shirt waist, and rough-dry collars and cuffs.
Ironing gingham dress.

IV. Ironing shirt waist and collars and cuffs.

V. Making rice starch.
Washing and clear starching fine muslin.

VI. Washing and ironing embroidered linen.

VII. Washing and ironing embroidered flannel, small shawl, or woollen dress goods.

VIII. Washing laces; steaming velvet.

Course I: Lesson I

Bed Linen (Pillow Cases). — Introduction, including outline of course and plan of work.

Talk on cleanliness as a necessity from the points of appearance, comfort, and personal and public health.

Talk on water with experiments in softening hard water.

Temporary hard water can be softened by boiling. Permanent hard water cannot be softened by boiling. Both can be softened by the addition of an alkali or soap. Water for experimental purposes may be made temporarily hard by the addition of lime water, permanently hard by the addition of calcium sulphate, commonly known as gypsum.

Talk on soap and alkalies.

Practice Work. — During talks on water and soap have pillow cases soaking in warm soapy water. With a little rubbing wring them out of this into clean warm suds. Rub them on the board, put them through the wringer. Put all articles together into the boiler with a cold soapy water, heat gradually, and let them boil from ten to twenty minutes. Have the first rinsing water warm, the second may be cold. Put the articles quickly through a bluing water, and hang them to dry. Washing and rinsing must be done in individual tubs, boiling and bluing in one large boiler or tub. Wash out tubs, wipe tables, benches, and utensils, loosen screws of wringer, and leave room in perfect order.

Course I: Lesson II

Table Linen (Napkins). — Talk on bluing. Show different kinds of bluing, as purchased and in water ready for use. Demonstrate with test-tubes and heat the effect of an alkali (sal soda in solution) on Prussian and aniline blues to bring out the necessity of careful rinsing.

Take out fruit and other stains; demonstration.

Practice Work. — Take out stains and put napkins a-soak in warm soapy water. Dampen and roll up pillow case. With the help of pupils show the shaking of sheet or table-cloth to straighten the fibre. Wash napkins, boil, rinse, blue, and hang them to dry.

Heat irons — if directly over a gas flame, wipe the moisture off several times before they become warm. Cover table with blanket and sheet, get out the paper, cloth, wax, and iron stand, and place at the right side of table. Shake and stretch pillow case into shape, and place it upon the board. Iron the hem first, then iron with the warp of the goods, first on one side of the pillow case, then the other, until perfectly dry. Fold once lengthwise in the middle, then again, and iron each fold in. Hang pillow case upon the bars to air.

Sheets are folded once lengthwise, then crosswise, bringing hems together. Sprinkle one-quarter yard from the ends, roll up, iron ends singly with a hot heavy iron, and balance of the sheet four folds together.

Course I: Lesson III

Body Linen (Waist and Drawers). — Talk on starch. Illustrate by pictures and with the microscope. Make starch for pupils while clothes are boiling. Demonstrate with a napkin or lunch cloth the folding and ironing of a table-cloth and a napkin.

Practice Work. — Put waist or drawers a-soak in warm suds.

Dampen and roll up napkins.

Wash body linen, boil, rinse, blue, starch, and hang it to dry. Put only the trimming of drawers into starch, rub it into them, and squeeze out the extra starch. The entire

waist may be starched. Heat irons. Cover table. Shake and stretch napkin straight, lay it right side up upon the table, having one hem away from you. Iron the hem first, then iron with the selvage. Turn the napkin and iron the wrong side. Fold the napkin right side out, selvages together, and iron the fold in, fold again, making a long strip, then twice crosswise, ironing all folds in. If napkins are small they may be folded in thirds like a screen. Any embroidery must be ironed on the wrong side over several thicknesses of flannel, and folded so the embroidery will be on the outside. Be sure that the linen is quite damp, irons are hot, corners square, and napkins folded true. Table cloths are ironed on the right side only, folded in the middle lengthwise, and ironed first one side and then the other until perfectly dry. They may be folded again like a napkin or to bring all three folds on the outside. A better way still is to roll the table-cloth lightly over a large roll, having it folded but once.

Course I: Lesson IV

Body Linen (Night-dress). — Talk on necessity of ironing articles perfectly dry and airing them well.

Give directions for ironing and folding waist and drawers.

Practice Work. — Put night-dress a-soak.

Dampen and roll up waist and drawers. Have starch made by pupils. Wash, boil, rinse, blue, starch, and hang night-dress to dry. Put only trimming into the starch.

Iron trimming of waist first, then take one section of the garment by itself, straighten it upon the table, lay the seam on the edge of the table toward you, and iron with the warp of the cloth. Arrange the other sections in like manner, never ironing beyond the seams, and the garment will be in perfect shape when finished. Fold the waist in a long strip, then crosswise until little but trimming appears.

Iron the band of the drawers first, then the trimming, and lastly the body of the garment, leaving every part perfectly dry. Any embroidery must be ironed on the wrong side to bring out the design, and lace must be ironed and then pulled out to soften it.

Course I: Lesson V

Colored Cotton Goods (Gingham Apron and Colored Stockings). — In recent years dyeing has greatly improved, and to-day we rarely find anything but "fast colors" in wash goods. If the color is doubtful, it is wise to wash a piece of the material to find out what treatment it needs. If the color runs, salt or white vinegar may set it. Use one tablespoonful of either to a gallon of water. Perhaps it will be necessary to use alum and water in the same proportions; this also makes the material less inflammable. Ordinarily it will be sufficient to wash colored material in a cool or moderately warm suds, rinse it quickly, and hang it wrong side out to dry in the shade. Always use a pure soap, and never rub it upon the material.

Practice Work. — Dampen and roll up night-dress. Make soap solution from direction given on page 292. Be sure that the soap does not contain an excess of alkali. Put enough of the soap solution into a tub of warm water to make a weak suds, wash the garment quickly, squeezing the dirt out rather than rubbing it, rinse quickly through several waters, acidify the last water if the color has been weakened by the soap, starch the garment, and hang it out at once, wrong side out, to dry in the shade. The sun is liable to fade the color. Colored garments should never be allowed to lie around wet.

Put stockings into a clean cool suds and wash quickly. If the color is doubtful, put the foot only in at first, rub it well and soap it if necessary, turn the stocking wrong side

out, finish the foot, then quickly wash and rinse the whole stocking, and hang it to dry wrong side out.

Iron the trimming of the night-dress first, then the sleeves, and lastly the body. The ironing board is needed here that the material may be ironed singly. Fold the night-dress into a long strip, the width of the trimming at the yoke, double the sleeves behind the yoke, leaving only the trimming visible at the side, fold once crosswise, and hang the garment to air. When ready to put away, fold the garment several times crosswise until little but the trimming shows on top.

When stockings are nearly dry put the left hand inside of each and straighten it, then as the hand is withdrawn follow it with a warm iron held in the right hand.

Course I: Lesson VI

Clear Starching (White Apron and Handkerchiefs). — Clear starching was the dainty work our grandmothers did with fine caps and kerchiefs. The starch used is very thin and clear, hence the name. The material is always clapped until nearly dry, then ironed.

Practice Work. — Dampen and roll up colored apron. Soak white apron and handkerchiefs in warm suds. Make thin starch with one level tablespoonful of cornstarch and one quart of water, boil well, and add a very little bluing. To find out that the starch is the right consistency, dip a piece of muslin into it and iron it. The muslin should seem like new, never be stiff or rattle. Squeeze the dirt out of the muslin, never rub it on the board. If it is soiled, rub it very gently between the hands. Boil, rinse well, blue, and put the muslin into the thin starch. Wring the muslin between cloths but do not twist it, shake and clap it between the hands until dry enough to iron. Stretch it

into shape upon the board, iron first the strings, next the band, then the hem, and lastly from hem to band. Be sure that each part is left dry and free from wrinkles. If a part dries too soon, rub it lightly with a damp cloth and iron it again. Handkerchiefs should be soaked in a strong suds by themselves, especially if the owner has been suffering from a cold. They should be well boiled, but do not need starch unless they are very thin; in that case put a little starch into the bluing-water. This makes the linen seem like new, no stiffer. Usually handkerchiefs are hung in the sun to bleach and dry, then they are sprinkled and ironed with a hot iron while yet quite damp. This stiffens them. Fine embroidered handkerchiefs may be clear starched, clapped dry, and ironed wrong side up over several thicknesses of flannel. Fold handkerchiefs like a napkin, square and true.

Iron colored apron as you did the white one, and hang it to air.

Course I: Lesson VII

Wool (Underwear). — Under the microscope we see that the wool fibre is composed of numbers of sheaths, about three thousand to the inch. The outer edge of each sheath or section is uneven and often jagged. These little points hook into each other when the fibres are slipped by, and when they would slip back to their original position the little hooks hold fast and the material shrinks. This change of position of the fibres is caused by rubbing or by the expansion and contraction of heat and cold. Poor soaps tend to thicken flannels; and if soap is rubbed into flannel, it is hard to remove without shrinking the material. As we do not wish to have flannels shrink, care must be taken that conditions are right.

Practice Work. — Make soap solution. Shake and brush

underwear to get all the loose dirt out of it. Make a suds in two or more tubs, having temperature of all the same — about 100° Fahrenheit, the temperature of the body — that is, so that the hand can very comfortably be held in the water. Add half a tablespoonful of ammonia for each gallon of water and put underwear a-soak for ten minutes or twenty. Squeeze the dirt out, never rub it. Put the garment through a wringer, do not twist or wring it by hand. Never rub soap on it. Put it through a second suds and a third if necessary. If a soiled part does not yield to this treatment, stretch it upon some smooth surface and with a soap solution on a soft brush, rub it. Rinse the garment in several waters of the same temperature as the first. If the water is hard, add a little soap solution to soften it. Rinse until the water is clear. Stretch the garment and hang it to dry where it is neither hot nor cold. Underwear should be stretched and pulled into shape occasionally while drying it, but it does not need to be ironed.

Course I: Lesson VIII

Silk (Handkerchiefs and Ribbons). — Silk under the microscope is a smoothly continuous fibre. It is easily injured by alkalies or heat. It needs the same treatment in the laundry as wool.

Practice Work. — Make soap solution. Put silk a-soak in warm suds, unless the color comes out or runs, when it should be washed at once. Squeeze the dirt out of it. Put it into a second suds like the first and then through several rinsing waters. Do not wring or twist silk, squeeze the water out of it, or let it drip until nearly dry, then iron with a warm iron until dry. A hot iron will make silk stiff. If the silk has a crape-like weave, take the handkerchief from the water without wringing, straighten it

on to the table and let it adhere to it until perfectly dry. Do not iron it. Plain silk may be treated in the same way.

Ribbons must not be rubbed or squeezed together in the hand. Strip them through the hand, put them upon the table, and with a soft brush loosen the dirt, brushing always in one direction. Rinse them well, and while still wet, straighten them upon the table, let them adhere and remain until perfectly dry.

EIGHT SUPPLEMENTARY LESSONS

Course II: Lesson I

Body Linen (Underskirt). — Talk on ironing, folding, and airing, and the care necessary to produce good results. If conditions are right and pains taken, results will be satisfactory, but patience and practice are necessary for perfect work.

Review of principles of washing.

Practice Work. — Put underskirt a-soak in warm suds. Make starch. Wash garment, gather hem of skirt in the hand, and rub the edge of it on to the board; if any part is still soiled, rub soap on to it before putting it into the boiler. Boil, rinse, blue, starch, and hang skirt to dry. Put only the hem and ruffles into the starch, rub it into them, and squeeze out the extra starch. Skirts should never be stiff around the hips. Hang the skirt to dry wrong side out. Attach it to the line by part of the hem, letting the rest hang so that the air can get in and dry it quickly.

Course II: Lesson II

Colored Goods (Gingham Dress and Shirt Waist). — Review of principles underlying laundering colored material.

Practice Work. — Dampen and roll up underskirt. Make soap solution. Make thin starch. In a warm, weak suds wash first the garment having least color, or the one you know to be fast in color. Possibly the second garment may be washed in the same water as the first, but it would be better to make a clean suds for it. If the hem of the dress is soiled, it may be gathered in the hand and just the edges rubbed on the board. Best results are obtained with least rubbing when fine materials and delicate colors are concerned. Rinse quickly, put entire garment into the starch, put through the wringer to get out the extra starch, shake, and hang it wrong side out in the shade to dry. Hang it so that the garment will be nearly in the shape you wish it to be in when ironed, but do not allow the gathers to hang down where the moisture will run into them, or the sleeves to get out of shape. Should you try a sample of material and find that the color was touched by soap, try washing it in bran water, using it just as you would soap-suds.

Heat irons, get out skirt board, also paper, old cloth, wax, and iron stand. Have bowl of water and clean cloth convenient. Put paper on the floor under the board to keep the skirt clean. Begin with the ruffles, taking the top one first, then the next. Keep the unironed part covered so that it will not dry out. After the ruffles iron the band, then put the board inside the skirt and iron one breadth or section at a time, taking first the hem, then the goods under the ruffles, then from ruffle to band. Move the skirt and take another section in like manner. Leave each part smooth and dry; if the material dries before you get to it, moisten it slightly with a damp cloth just before ironing it. Hang the skirt to air; when it is ready to put away, bring the folds in the middle of the front and the back together, then lay each side back upon itself, fan-like. Make several cross folds until little but the trimming shows.

Course II: Lesson III

Thick Starching (Rough-dry Collars and Cuffs).

Practice Work. — Make thick starch, set it in water to cool. Dampen and roll up gingham dress. Stretch and tie a damp cloth over a table or use the clean uncovered table. Put the bowl of starch in the middle of it and have several bowls of clean water with clean cloths convenient. Dip parts to be starched into water and wring very dry, that is cuffs, neckband, and plait on front of shirt waist, and rough-dried cuffs and collars. Stretch and straighten the cuffs and collars, lay them upon the table wrong side up and rub starch into them with the hand, continue rubbing until the starch can be seen on the right side. Be sure that the edges are full of starch. Clear off the extra starch with a clean damp cloth and hang the pieces on a string or attach them to a piece of cloth and place them before the fire to dry. Be sure that each piece hangs straight and in good shape. Treat the cuffs, band, and plait of shirt waist in the same way. Be careful not to get starch upon the other parts; if you should, clear it off with a damp cloth.

Heat irons for gingham dress. Iron trimming at neck and sleeves first, then waist and sleeves, and lastly the skirt, the part that would muss most easily. Whenever possible, iron gingham or prints on the wrong side; they look more like new. Hang the garment to air before putting away.

Course II: Lesson IV

Ironing Thick Starch Work. — The dampening of thick starch work must be done three or four hours beforehand, by children if possible, otherwise by teachers. Reserve one or two articles to show process in class.

Practice Work. — Never sprinkle thick starch work, but

dampen it by contact with a cloth wrung but half dry from cold water. Fold the collars and cuffs up in the damp cloth. Fold a damp cloth over the stiff parts of the shirt waist, sprinkle the balance, and roll or fold it up wrong side out. Cover the bundles and place them under a weight if possible. Heat both plain irons and polishers, and know that they are perfectly clean. Place the collar or cuff upon the table wrong side up, iron it lightly with the polisher, first one side and then the other, until it begins to stiffen; then on the right side apply pressure to stiffen and polish; work quickly and bring the weight of the body to bear upon the iron. Polish the wrong side a little, but leave the right side smooth and shiny. Do one piece after another and lay them aside. Use a damp cloth as little as possible, for it takes the starch out and leaves blisters. Leave any soiled spot until the piece is dry, then rub it lightly with a damp cloth. When ready to curl collars and cuffs take a common iron, pass it over the piece several times to warm it, then with it wrong side up grasp the edge of the piece with the left hand, the iron close upon it; as the iron is drawn back follow it closely with the left hand, curling the piece as you go. Work from both ends of the piece, then hold it in shape in the hand for a minute and stand it on edge. Turnover collars must be ironed straight first, folded with the hands, and pressed with the iron at the back. If the domestic or dull finish is desired, a damp cloth brushed lightly over the piece will remove the polish. With a polisher iron the cuffs of the shirt waist, the part of the sleeve next the cuff, and the neckband. With a common iron take the yoke first, then the back, plait down the front, fronts, and sleeves. Leave no creases in the sleeves or any part. Polish the plait down the front, and hang it to air.

Instead of thick starch, raw starch is often used for collars, cuffs, etc. After the shirt waist has been sprinkled,

the cuffs, neckband, and plait may be dipped into the raw starch, the starch rubbed into the parts, the waist rolled up, and allowed to lie for half an hour. Straighten the cuff, put it on the table with a piece of muslin over it, iron until dry both sides, pulling the muslin off frequently. Dampen it thoroughly with a wet cloth, and iron again in the same manner, dampen and iron a third time, in this way cooking the starch in the cuff instead of out of it. The last time take off the muslin and polish the cuff. Finish the band and plait in the same way.

Course II: Lesson V

Clear Starching (Fine Muslin Sash Curtains). — The best clear starch work is done with rice starch; it is very smooth and capable of great dilution. Infants' dresses may be laundered in this way, also fine muslin in caps, handkerchiefs, and the like. Starch must be made beforehand.

Practice Work. — Make soap solution.

Shake and brush dust out of curtains, put them a-soak in warm suds. Wash them gently, always squeezing the dirt out. Wash them in a second or third water. If fine muslin must be rubbed, put a piece of strong muslin under it and rub both together. When boiling it, tie it in a bag. A quantity of absolutely boiling water may be poured over it, but boiling is considered more cleanly. Rinse, blue, and put the pieces into thin starch. Lay them between cloths, and put them through the wringer. Clap each between the hands until it is dry enough to iron, straighten it upon the board, and iron smooth and dry, taking the hems first, then ironing with the warp.

Course II: Lesson VI

Embroidered Linen. — Review work with linen and silk.

Embroidery silks are fast colors, but nevertheless require

careful laundering. They should be washed quickly, and the moisture absorbed by an old dry sheet.

Practice Work. — Make soap solution. Wash embroidered linen quickly in a warm suds to which a teaspoonful of borax has been added. Do not rub the linen other than between the hands or with a soft brush. Plunge it up and down in the water. Rinse it well and quickly, changing it from one fresh water to another without wringing. If the color runs, let the cold water pour through the linen, carrying the color with it. Put the wet linen between several thicknesses of old cotton cloth which will absorb the moisture. Shake the piece to hasten the drying. When it is perfectly dry, lay it face downward upon several thicknesses of old sheet. With a wet cloth go over a portion of the linen at a time, but over the embroidery quickly, so that it will not be moistened. Straighten the material, then with a hot iron and firm pressure dry and stiffen the linen, but do not steam the silk or it will lose some of its gloss. Iron always with the straight of the goods, never bias. Let the piece lie upon the table to air, do not fold it, but roll it over stiff paper. Fringed pieces should be shaken well while wet. When dry, brush the fringe with a soft brush and trim it.

Course II: Lesson VII

Wool (Embroidered Flannel or Small Shawl). — Review work with woollen underwear.

Practice Work. — Make soap solution. Follow directions for washing wool given in Lesson VII, Course I. If the color has been weakened by the soap, add white vinegar to the last rinsing water, one tablespoonful to one gallon of water. Ammonia will strengthen the color of black goods. Hang the goods straight by the edge, and when nearly dry iron with a warm, never a hot, iron until perfectly dry. Press

rather than shove the iron, and go over it again and again. Do not fold it, but hang it to air. If the flannel is embroidered, press it on the wrong side over several thicknesses of flannel.

All woollen dress goods may be treated in the same way. Use plenty of water, and pass the goods from one water to another without wringing; draw the material through the hands, but do not crease it. Take it dripping from the last water, hang it by the edge, and when nearly dry iron it. Cover the table with cotton goods about the color of the material to be ironed, and place the goods on it wrong side up. A piece of colored cambric may be put between the goods and the iron, then iron until it is quite dry. Have the irons barely hissing hot, change them often, but do not press hard enough to flatten the threads of the material. After the material has aired, roll it, never fold it.

Course II: Lesson VIII

Laces, Chiffon, and Velvet. — Real laces will thicken slightly, even when washed with the greatest of care. It is best to keep them in powdered magnesia when not in use. The magnesia absorbs the oily dirt, especially when a hot iron is applied to them, the lace being between paper.

Practice Work. — Make a warm suds of some pure soap. Add one teaspoonful of ammonia to each quart of water. Let the lace soak. If very yellow, let the lace lie in soapy water in the sun for several days, changing the water daily. Wash by squeezing the dirt out, rinse well in several waters, put into a weak solution of gum arabic, made by pouring one pint of boiling water over gum arabic the size of a large pea. This will give the lace a little body, but will not perceptibly stiffen it. Pat and pull it into shape, and pin it down upon flannel. Put a pin in every point and pearl of the edge, have it straight and true, and let it dry.

Black lace may be washed in one cup of strong coffee to which has been added one tablespoonful of ammonia. Rinse first in clear, then in gum arabic water, pat and pull into shape and pin it down.

Chiffon or veiling must be washed according to directions given for silk. Squeeze it gently from water to water so as not to pull the threads. Lay it between cloths to absorb the moisture, and when nearly dry iron with a cool iron on the wrong side. When soap touches the color, it may be that bran water will not. Use it as you would soapy water.

Velvets must be brushed first to get the dust out, then invert a hot iron, put over it several thicknesses of wet cloth and one of dry. Draw the velvet across the iron, brushing the pile softly against the nap. The steam will raise the pile and take out the creases.

MAY

HOUSEHOLD PESTS; HOUSE CLEANING

The Common Insect Pests of the House

By S. MARIA ELLIOTT

Boston, Mass.,

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CHAPTER XIII

HOUSEHOLD PESTS

By S. MARIA ELLIOTT

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Outline

LESSON

I. Study of a Typical Adult Insect.
Study of Indirect Metamorphosis.

II. and III. Insects injurious or disagreeable to Persons.
- Lesson II. Mosquitoes and Flies.
- Lesson III. Bedbugs and Fleas.

IV. and V. Insects injurious to Food or Food Supplies.
- Lesson IV. Cockroaches.
- Lesson V. Ants and Miscellaneous Pests.

VI. and VII. Insects injurious to Clothing or Fabrics.
- Lesson VI. Moths and Silver-fish.
- Lesson VII. Carpet-beetles and Crickets.

Materials. — Specimens of the insects to be studied: dry, alcoholic, and live specimens whenever possible; live specimens in boxes with glass side, in tumblers, or in small bottles; specimens of eggs, egg capsules of cockroach, larvæ, pupæ if possible; charts and diagrams; magnifying glasses; needles, insect pins, or long slender "mourning" pins for separation of parts; small pieces of cork to hold pins and mounted specimens; bits of cardboard or thin wood on which eggs may be glued; samples of cloth eaten by moths, carpet-beetles, silver fish, cockroaches, etc.; samples of materials stained or damaged by bedbugs, cockroaches, and flies; ants' larvæ and pupæ from house or field; "lady birds" for comparison with carpet-beetle.

Methods.

Aims. — 1. Recognition at sight of adult, pupa, larva, egg-case or egg.

2. Knowledge of
   - (*a*) Most harmful form of each insect.
   - (*b*) The favorite foods; breeding places; time and season for breeding or devastation; habits of life.
   - (*c*) How to prevent their attacks.
   - (*d*) How to drive away or kill the pests when they are present.
   - (*e*) How to repair the damage inflicted.

Processes.

1. Examination of live and dead specimens.
2. Examination of all forms of each insect, whenever these are obtainable or widely different from adult.
3. Study of pictures, if specimens not practicable.
4. Collection and rearing — to familiarize form, number of progeny, and rapidity of development.
5. Examination of articles damaged by insects — note character of such damage, whether stain, odor, or destruction of material. Injury or disease of person.
6. Study of materials and apparatus for prevention or extermination. Suggestions for other apparatus which might be used.
7. Study of applications which relieve or cure injury to person.
8. Cautions for use of materials.
9. Oral and written descriptions. Sketches and diagrams of insects and apparatus.
10. Application of principles at homes and comparison of results.

Experiments. — Breed each form studied. Watch metamorphosis and rapidity of development.

The making of parti-colored larval cases by moths, from different colored cloths.

Experiment with different colored flannels and different materials to find favorite food for moths and carpet-beetles.

Try effect of Mayweed (*Anthemis cotula*); chamomile (*Anthemis arvensis*) or (*Anthemis nobilis*); feverfew (*Chrysanthemum parthenium*) and the common white daisy (*C. leucanthemum*). See if they can replace the imported insect powder.

NOTE. — Breeding cages may be made out of wooden boxes with a piece of glass fitted tightly into one side, or arranged to slide up and down or from right to left in a groove. This should have a layer of moist sand in the bottom. Most insects require moisture.

A flower pot, with moist soil, and a lamp chimney covered with cheese cloth or thin muslin will answer for a cage.

For mosquitoes place in cage a small dish of water. For fleas omit the moisture until need of it is shown. Each insect should have a separate breeding place. Furnish each insect with the food he chooses when inside the house.

SUGGESTIONS TO TEACHERS. — Encourage pupils to make collections from their homes. This may be done so delicately that their sensitiveness is not aroused. They do this in order to learn how to prevent and remedy in the future.

Alcoholic specimens are easier to manipulate for examination of certain parts, but these are usually changed in color; and hairy portions do not show well. Have both alcoholic and dry specimens.

Keep dry specimens for examination in tin boxes or glass bottles, and sprinkle a little insect powder over them.

Especial cautions must be emphasized concerning the use of liquids with inflammable vapors. The vapor of the naphthas is heavy and will settle toward the floor. If used in large quantity on carpets, the vapor may pass through the floor and collect in the room beneath, as in the cellar. Explosions have occurred in cellars thus affected, when a light

was brought in. Corrosive sublimate is a deadly poison when taken internally. Antidotes for poisons should be taught in emergency lessons.

Sulphurous vapors are irritating to the mucous membranes of persons, bleach moist fabrics, and tarnish many metals. Be careful in the use of sulphur for purposes of fumigation — danger of fire, of irritation, tarnish, and bleaching.

Turpentine vapor takes longer than naphtha to evaporate, and will be detected from furniture in a warm room for some time. It is an irritant to the skin of certain persons.

Be careful that live specimens do not escape. Examine in small vials or small boxes, where they can be controlled.

Lesson I

Materials. — Typical insects of large size. The locust or "grasshopper," or the large cockroach will show the characteristics of the insects with direct metamorphosis.

The butterflies or moths furnish examples of insects giving indirect metamorphosis.

Magnifying glasses.

German insect pins or long, slender "mourning" pins or needles.

Flowers of *Pyrethrum* or related species.

Samples of pure insect powder.

Diagrams and charts for illustration of parts and related forms.

General Information or Introduction. — The healthy house is the clean house. The clean house must stand upon clean foundations, amid clean surroundings. It must be built of clean materials, supplied with clean air, clean water, clean food, and clean furnishings. All of these must then be kept clean in order that the clean occupants may reach that height of sanitary cleanness which is health. If all houses

at all times could show a bill of health with the above items, there would be no need of any study of household pests.

It is because any house may sometimes depart from the standard that it is necessary to study the forms, life history, and habits of insects which invade the house, and the preventive and remedial methods which govern the protection of the household and household property. Only a few species out of the many which the insect world furnishes come under the head of Household Pests.

The student of domestic science should seek all possible information concerning insect life in general, besides that special knowledge which applies to *the few* which are likely to be met with as foes.

The life history of insects is especially interesting because the periods of growth or metamorphoses are often more apparent than in the higher animals and man. Four distinct stages appear — egg, larva, pupa, imago.

When between the egg and the adult there is a stage where no feeding and no movement from place to place goes on, the changes or the metamorphosis are said to be "*indirect*"; where between egg and adult there is no quiescent stage, the metamorphosis is "*direct.*" Some writers still retain the older terms "complete" for "direct"; "incomplete" for "indirect."

The egg is always minute, sometimes microscopic; it gives birth to the larva, commonly known by one of several names, grub, worm, maggot, caterpillar, wriggler, etc. The larva may or may not moult once or several times before passing into the next stage, the quiescent or pupal form. Each moult means an increase in size, for when the little body gets too big for its skin, a new, soft, and flexible skin has already formed beneath the old. The old skin is ruptured, and the larva emerges. Man has to remove his old clothes and then put on the new. Insects come out of their

old clothes already dressed in the new suit, perfectly fitted externally and internally.

After a while, the exact length of time governed largely by conditions of food and warmth, the larva encloses itself in a case or sac made either from new materials foreign to the body, or of the dried and hardened skin of the larva itself.

This is the pupa, called chrysalis in the butterfly and nymph in the honey-bee. No food is now taken, and there is no movement except slight muscular contractions when the pupa is disturbed.

At last the pupal period is past, and out from the case comes the imago or full-grown, perfect insect, — at first weak and trembling, but rapidly becoming used to its new body and new conditions of life.

In cases of direct metamorphosis the young differ very little from the adult except in size, the changes being so gradual that to the casual observer they are unnoticed. The most obvious difference in some cases is the presence of wings in the pupa and imago where they were absent in the larva. All stages feed. Many adults live only a few days after emerging from the pupa. They reproduce their kind and die. The time intervening between the egg and adult stages varies from a few days with many insects to seventeen years with the Cicada.

Insects have bodies made of three segments, which may be so nearly united that they are distinguished with difficulty, or they may be plainly shown as in the wasps and ants. These three segments are again divided into rings, the normal number being thirteen. It is seldom that this number can readily be determined because two or more are often consolidated.

The first segment, or the head, bears the usual appendages, eyes, antennæ, and mouth parts; the middle, or thorax, bears

the legs and wings, if the latter are present; the last, or abdomen, may or may not bear certain appendages for protection, for aids in locomotion or for digging.

The typical insect has three pairs of legs and two pairs of wings. Both pairs of wings may be membranous and flexible, or the upper or front pair hardened into wing covers as in the beetles.

The segments are united by flexible joints which aid greatly in the rapid movements characteristic of most insects.

Not alone the body, but also the appendages are ringed or jointed. The entire structure shows admirable adaptability to the conditions under which insect life exists.

Insects take in air through small slits or holes, called *spiracles*, on each side of the abdomen. Anything which partly or completely fills these spiracles stops respiration and stupefies or smothers the insect. Hence the effect of powders, oil, etc.

The antennæ, preëminently, are organs of touch and in many cases are extremely long and sensitive, enabling their possessors to be warned of impending danger or disagreeable conditions long before actual harm is done. Some insects show an acute sense of smell, but just what parts respond to this stimulus is not known.

The organs of hearing are sometimes at the bases of the antennæ, and sometimes on the wings. Some insects show extreme sensibility to sound.

The mouth parts of insects vary in number and show wonderful modifications in structure according to the character of the food upon which the insect lives in each stage of larva or adult. In the former, they are used chiefly like shears for cutting or biting and are hard and horny; in the latter they may be adapted for the cutting or biting of solids, or for the sucking or lapping of liquids. Then there are

parts which help to catch, to kill, and to hold the food. Some carnivorous insects secrete fluids which stun, kill, or partially dissolve the victim before they feed upon it.

Most of the insects which infest the household may be reared in captivity and their metamorphoses watched and studied. Such study is intensely interesting even in those cases where the presence of the free insect arouses only disgust and murderous desire.

Probably all insects were originally out-door forms and the few have become in-door pests because of the favorable conditions for protection and food there offered. Their food was primarily raw vegetable juices, but some have already found an entire animal diet more to their taste, while others are pleased with variety in their bill of fare, taking a taste of blood or of cooked foods if occasion serves. A few, like the bedbug and flea, are such lovers of blood that they have well-nigh become parasites on man or the warm-blooded animals.

"In the case of the clothes moths, the larvæ of all of which can, in case of necessity, still subsist on almost any dry animal matter, their early association with man was probably in the rôle of scavengers, and in prehistoric times they probably fed on waste animal material about human habitations and on fur garments. The fondness they exhibit nowadays for tailor-made suits and expensive products of the loom is simply an illustration of their ability to keep pace with man in his development in the matter of clothing from the skin garments of savagery to the artistic products of the modern tailor and dressmaker," writes C. L. Marlatt in "The Principal Household Insects of the United States."

Insect Powder. — Insect powder, which is so commonly used both for the prevention and extermination of insect pests, is made from several species of *Pyrethrum* or *Chrysanthemum* the *C. roseum* furnishing the powder known as

Persian insect powder. Other names for the same powder or for the same use are Dalmation and buhach. The Californian buhach is especially effective. The powder is made of the pulverized flower heads. It is not poisonous to animal life except in the case of insects. Adulteration is easy and common, as there are many related species which may be used without detection by the casual observer and which are less expensive. The pure powder should be used, for much less is required.

The *Pyrethrum* may be grown in most climates favorable to the ordinary camomile plants, and the country housewife may well experiment with her mayweed and feverweed to see if they will not assist her in ridding the house of troublesome insects.

Lesson II

Flies and Mosquitoes

Materials. — Insect powder, pennyroyal herb and oil, quassia chips, Chinese incense sticks, molasses, black pepper, egg, cooking soda, aqua ammonia, borax, salt, traps (home-made and patented), fly-drivers (home-made and patented), whisk broom, bits of meat "blown" by flies, liquids infested with fly "maggots" or pupæ, atomizer, plates.

Flies

Diptera — Muscidæ — *Musca Domestica* and Others. — Flies are a disagreeable, irritating pest to persons, and by their eggs they contaminate food supplies. Worst of all, their feet are admirably adapted for picking up disease germs, which may be carried, here as well as on the proboscis, from person to person, or from putrefying matter to person or food. This is true especially in cases of typhoid fever, where, as is often the case, the fæces, not disinfected, are thrown into

the common privy, or allowed to stand uncovered. This last is the chief reason why flies should be kept out of the house. Especially is there great danger of such carriage of contagion, where there are babies, as they are unable to protect themselves, and their delicate membranes of eyes, nostrils, and lips are more sensitive than those of adults.

Many cases are on record where the germs of consumption have been found in the bodies and in the droppings of flies, in rooms occupied by consumptive persons.

It is true that flies are scavengers, and it is their work to aid in ridding the world of filth; but we do not wish them to deposit the results of their scavenging upon ourselves or upon our food.

There are a number of species which may be found in houses, but the most abundant is the true house fly, which cannot bite or pierce the flesh, its mouth parts being adapted simply for lapping liquids. Some of the stable flies, however, have mouth parts which can pierce the skin, and they often come into the house. It is not necessary to distinguish between the species, as all should be kept out, if comfort, economy, and health are to be maintained.

The metamorphosis is indirect. The adults do not need description, although they well repay close observation and study, especially the head and feet. The favorite breeding place is horse manure, but the female will lay her eggs in all kinds of manure, as well as in any moist decaying matter — meat, fruit, garbage of all kinds. One dirty stable may furnish flies to a whole neighborhood. Dirty streets, neglected back yards, uncovered garbage barrels, invite the parent fly to deposit there her eggs. Each mother fly may lay over a hundred eggs at one time, and these pass through their four stages from egg to adult in from ten to fourteen days. The enormous numbers of flies are thus easily accounted for.

The larva is a long, segmented form, larger at the anal end, but showing no head except the small antennæ. Its mouth parts are hooks which aid in movement as well as in eating.

The adults remain torpid during the cold weather, reappearing in May or June, but usually not laying their eggs until August. Thus the greatest danger to food supplies which invite egg-laying is in this month.

With this insect, prevention is preëminently important. In cities the pest may be greatly diminished by strict attention to stable, street, and back-yard cleanness. The prompt collection of horse droppings from the street or stable; their storage in tightly covered receptacles, or the covering of them with lime when exposed; the burning of garbage; cleanness of yards, sheds, etc.; food materials kept well covered that no eggs may be deposited; no wet places left to furnish them food, — all these are absolutely necessary before diminution in numbers can be hoped for.

Another preventive measure is early and complete screening of doors, windows, and chimneys even, for in many localities and in houses where there are open fire-places the chimneys furnish comfortable shelters from wind and rain, while the smell of food draws the flies down into the house.

The common objection of the "men folks" that screens keep flies in rather than out is partly true. This may be overcome by making a few conical holes near the top of the screens, from the inside. These should be of such shape as would be made by a sharpened lead pencil, the large end opening into the room inviting the flies to walk in; the small end allowing them to squeeze through into the sunshine. They are seldom able to return in reverse order. Screens, too, so lessen the air and light supply and impair pleasant views, that their use is a doubtful blessing.

Flies are usually day-fliers, and as they prefer light and revel in sunshine, rooms should be occasionally darkened with only a small aperture into the open air or into a lighter room. The flies will seek the light or they may be forcibly encouraged to leave. Perhaps there is no better fly-driver than the many long, narrow strips of newspaper tied to a flexible stick. These switch and rustle so angrily that the flies are frightened by both noise and movement, and seek to escape into the light.

Various traps, from the tumbler of soap-suds covered with a perforated paper or card, the underside smeared with molasses as a bait, to the more elaborate varieties of wire gauze and other devices, are effective to a greater or less degree. "Fly-papers" may be put under the head of traps. The ordinary whisk broom may be effectual to kill individual flies when they would escape from a smooth surface. It acts like the wire "spatter."

Certain mixtures are recommended to attract, to stupefy, or to poison them; to insure death the flies should afterward be collected and burned. Two of these are given. Beat together the yolk of an egg, a tablespoonful of molasses, and the same of finely ground black pepper; spread thin.

Boil $\frac{1}{4}$ ounce quassia chips in 1 pint water; mix with this 4 ounces molasses; place in shallow plates.

Preventive Measures. — Strict and thorough care of stables and streets, cleanness in house and surrounding, absence or disinfection of breeding-places, early and thorough screening.

Remedies. — Drive out into light; darkened rooms with small outlet into the light; traps, stupefying mixtures.

Mosquitoes

Diptera Culicidæ — *Culex pungens* **and Others.** — The mosquito is by some persons considered to be a pleasing

musician, by others a torment, and by others still an enemy armed with no mean weapons.

The adult is too common an insect to need description. Its habits, however, are unknown to many, while its larval and pupal forms are seldom seen or recognized as such by any but the student. The adult mosquito is a land insect, feeding only upon liquid food which it sucks up through its proboscis or tubular tongue. It lays its eggs, however, upon the surface of water, because its larva and pupa live only in water. They require atmospheric oxygen for respiration. This they get just at the surface of their watery home, and take it in through a special tube called a respiratory siphon. The long slender abdomen is so supple and the movements so jerky that the mosquito larvæ are familiarly called "wrigglers."

The natural food of mosquitoes is no doubt the juices of plants, and blood only a luxury; indeed, the male often lives his little span of life without any nourishment, and the female does not necessarily take human or other warm blood at any time.

Although there are upwards of thirty species recorded in the United States, to most persons a mosquito is a mosquito, and scientific differences have no interest.

It is supposed that the eggs are laid early in the morning before daylight. They are fastened together in masses of various shapes, in rows, with three to forty eggs in a row, so that in one egg mass there may be over four hundred eggs. The individual eggs are minute, a little broader at the bottom than at the top, whitish in color except at the tip, where they are a dark gray-brown.

The changes from egg to adult may be passed through in ten days under favorable conditions, but in cold weather or cold places this time may be greatly prolonged. The eggs, however, often hatch in less than sixteen hours.

The larvæ leave the eggs from the under side, and are thus in the water immediately, where they live until the adult stage.

These two facts in the life history of *Culex* lead us to the most important preventive measures. Because they hatch so quickly, and in such numbers, great precaution must be taken to promptly abolish all favorable breeding places. Because they live in the water and still must breathe our atmosphere just at the surface, if we can make it impossible for them to get this air we shall kill the larvæ. If we can prevent their breeding or kill the larvæ, we shall rid ourselves of the adult pest.

Any quiet stretch of water may invite the mother insect to deposit her eggs. An uncovered tub of rainwater, a forgotten pail of water left out-of-doors over night, a stagnant dooryard or barnyard pool, a water tank, a sink drain emptying upon saturated ground, or the privy vault where liquid sewage stands, — all of these and similar places, to say nothing of swamps and brackish marshes, still ponds or lakes, may become stocked with mosquito larvæ. They lay their eggs only on still water. Running water or tanks which are kept agitated by any means are exempt from mosquitoes.

Complete drainage and care that no available breeding place be carelessly left about the house or in the vicinity is of greatest importance.

Breeding places that cannot be removed should have their surfaces covered with kerosene. This not only catches the adult females as they attempt to lay their eggs and "before the eggs are laid," but it prevents the larvæ from obtaining air, and, therefore, they die in the water. For ponds and lakes where kerosene would be objectionable, certain fish may be introduced, which will feed upon the larvæ. About one ounce of kerosene to every fifteen square feet of water

surface, with monthly renewals, has been found to be efficient.[1] It is far easier to keep mosquitoes out of the house than to kill them after they are inside. Complete screening of windows, doors, and beds comes first among remedial measures. Strong odors are disagreeable to them, so that burning incense sticks, insect powder, or other fragrant smudges may clear a room of the pest. The herb pennyroyal, *Hedeoma*, either fresh or dry, or the oil of the same, is also effectual.

The adults often hibernate during the cold months in cellars or outbuildings. Sometimes they are found on ceilings in such quantities that they may be caught by placing under them cups of kerosene, and scraping them into the oil or by holding a lamp under them.

Some persons seem to be immune to the "sting" or "bite" of mosquitoes, objecting only to their monotonous hum; others feel a momentary irritation from the puncture; while others suffer pain and inflammation. The irritation may be allayed and inflammation reduced by applications of cooking soda, borax, ammonia water, moist salt, and any cooling lotion.

Preventive Methods. — Breeding places abolished, breeding places covered with kerosene, agitation of water, fish in bodies of water.

Remedies. — Screens, smudges, strong odors.

Lesson III

Bedbugs and Fleas

Apparatus. — Kerosene, naphtha, corrosive sublimate tablets, hot water, insect powder, varnish, feathers, bulb syringe, spring-bottom oil can; pieces of wood and bedding showing stains from mouth secretions and excrement.

[1] "The Principal Household Insects of the United States." — L. O. Howard and C. L. Marlatt, U.S. Dep't. of Agriculture, Div. of Entomology, Bull. 4.

Bedbugs

Hemiptera — Cimicidæ — ***Cimex lectularius.***

"Nature never loses a crack or a crevice, mind you, or a joint in a tavern bedstead, but she always has one of her flat-plattern live time-keepers to slide into it." — Oliver Wendell Holmes.

Since the above sentence was written by our genial Dr. Holmes the metal bedstead has largely superseded the wooden one with its many cracks and crevices. Yet "No bedstead has yet been made which does not afford it shelter," says John B. Smith in his "Economic Entomology," as late as 1896.

Its presence in a country house may be considered a sign of filth and neglect, but it cannot be thus construed in a city house. Yet, although its occasional appearance in the latter may be excusable, its continuance means inexcusable carelessness, and should be thought a disgrace; for, when once seen and known, watchfulness and proper care will exterminate it. No easy methods, however, will avail. The housewife must fight for her victory.

Conditions in cities favor the introduction of this human parasite into the houses. It may be brought in on clothing out of crowded street or steam cars; it is apt to get into trunks and bags during travels; new furniture even may be infested; or the bug may migrate from some neighboring house. They have been seen to drop from the holes of cane-seated chairs. When a house is vacant or closed for a long time, and the food supply is thereby unfavorable in kind or quantity, they often travel along walls, water-pipes, roof-gutters, etc. Apartments are often suddenly or continually overrun from such sources.

However disgusting the subject may be, it is wisdom to know the possible, and how to remedy what we may not be able to prevent.

The bedbug, unlike most insect pests, has been associated with man since the earliest times on record. The ancient peoples of Asia, the Romans, and other nations were familiar with it and its habits. In some parts of the United States it is known as the "chinch" bug, although this name belongs rather to an allied species which does not trouble the housewife. Other names are descriptive, as "red coats," "chintzes," etc. It probably, like the real "chinch," which feeds upon vegetable juices, was once a strict vegetarian. Like other insects which have long lived a parasitic life, it has almost lost its wings, for which man should be thankful. It is much easier to fight a foe that must depend upon legs rather than wings to effect an escape.

The metamorphosis is direct, the adult differing from the young chiefly in color and size.

The body is mostly abdomen, which, unless distended with blood, is flat and scarcely thicker than a sheet of thin paper, so that there is seldom a space so narrow that it cannot be invaded by a bedbug. Its head is set in a hollow and protected by extended flaps. The antennæ are jointed and hairy on both sides. It has the characteristic "buggy" odor, which aids in the detection of its whereabouts. The adults are reddish brown tinged with black; the young, a yellow-white changing into brown.

The eggs are minute, white, oval bodies with a low rim around one end. This end acts as a lid, and is pushed off by the escaping larva.

Cimex is extremely prolific, laying several batches of eggs during one season, and the eggs hatch usually in about a week. With such a pest and such progeny "eternal vigilance is," indeed, "the price of liberty" to the housewife.

Like the cockroach, the bedbug abhors light and conceals itself during the daytime. It naturally hibernates during the cold months, beginning active life with the return of

warm weather; yet in warm city houses it may remain active all winter. April is perhaps the month common to most parts of our country for the beginning of their breeding season.

If blood is wanting, the bedbug may feast upon the paste on papered walls, and picture moulding often forms its quiet, dry, undisturbed breeding place. This shows that it can live on very scanty food, when the dust collected in cracks and crevices is sufficiently moist for its needs. Indeed, specimens have been kept in sealed vials in laboratories for more than a year.

The adult is furnished with a fleshy underlip or beak, which holds four hard and sharp filaments called setæ. These puncture the skin and pierce the flesh by a sawlike movement while passing over each other. The beak is pressed closely to the wound, and through it the blood is drawn. It is easy to see how these mouth parts might carry contagion from man to man, or from tainted flesh to man.

Some persons are unaffected by the bite of this insect, not feeling the puncture nor knowing any swelling or irritation. Others feel the action of the setæ, and to some the bite is decidedly poisonous. The fluids secreted in the mouth enter the wound, and add their irritating action to that occasioned by the setæ.

Fortunate the city dweller who has never seen this pest in his house; but with persistent, intelligent watchfulness even so wary and secretive a foe may be outwitted.

Prevention should begin by brushing and shaking the clothes, when one has been in suspicious places. Articles of furniture should be carefully inspected, whether new or second-hand, especially the latter, for auction rooms and similar places are, from the decidedly cosmopolitan character of their possessions, very apt to be infested.

Any house or tenement should be carefully inspected before occupation. Look for the pests in cracks, in torn or loose wall-papers, and along picture mouldings. If there are signs of their former presence in the specks left from their excrement or mouth secretions, watch incessantly for their reappearance. Never let the enemy catch the housewife off her guard, for a day's advantage may mean the infestation of an entire room or house.

Cleanness everywhere, freedom from dust and fluff — this alone means freedom from insect pests.

If prevention prove unsuccessful and the enemy be found, declare a daily warfare until it is vanquished, and then — watch!

All eggs must be destroyed before any permanent success is gained. Bedsteads furnish the favorite breeding places as well as feeding places by night, and hiding places by day. They are the chief battle-ground. An occasional coat of thin varnish over all the woodwork under the mattress helps to drive away adults and to kill eggs.

Boiling water will kill both adults and eggs if it touches them. This may be used wherever it will not injure the finished furniture or spoil fabrics. Slats to bedsteads may have the ends immersed in boiling water.

Kerosene and naphtha are death to both forms. Kerosene is the safer to use in large quantities because of the extreme danger of fire with the naphtha. Infested upholstery or bedding may be saturated with naphtha, if left out-of-doors or not exposed to any flame for days. Kerosene has a more lasting odor, for it evaporates more slowly and will also leave a stain, if dust settles in it while the oil is evaporating. This makes its use more objectionable for fabrics.

Corrosive sublimate is effectual, but it is a deadly poison when taken internally.

A method which has been successful in many cases is the

persistent use of ice-water. This no doubt would prevent the development of the eggs, and its faithful use tends to the cleanness which alone is effective prevention.

Liquids are necessary, powders are practically useless, for the eggs are deeply concealed. Whatever liquid is used, it should be poured into holes or cracks and crevices, or injected from a spring-bottom oil-can or a syringe.

The inflammation consequent upon the bite of *Cimex* may be relieved by bathing with ammonia or a solution of cooking soda. Insect powder between the sheets of an infested bed may make sleep possible until morning permits the vigorous measures necessary for the extermination of the pest.

Preventive Measures. — Every possible precaution that shall prevent the entrance of the insect into the house on clothing, furniture, baggage, etc.; cleanness everywhere, especially clean bedsteads and bedding; metal bedsteads, wire mattresses; daily watchfulness as spring approaches.

Remedies. — Boiling water, ice-water, kerosene, naphtha, corrosive sublimate, varnish, insect powder.

Fleas

Diptera — Pulicidæ — *Pulex serraticeps* and Others. — The flea, which often becomes a household pest, is brought in chiefly by the pet cat or dog. The insects become dislodged from the hairs by the movements of the animal, and find new lodging places in cracks of floors or in meshes of carpets. Thence they jump upon the ankles of persons who disturb them by walking over their retreats.

The metamorphosis of the flea is indirect. The adult is a small, shiny, black insect, with a plump body encased in hard, tough, segmented scales. The neck tapers toward the head, which is small and furnished with a hard helmet fringed with bristles. The legs are long, and the two seg-

ments nearest the body enormously developed for leaping. The antennæ are short and stout.

The egg is a tiny, smooth and shining, white, oval body and normally is laid among the hairs of the cat or dog, not attached to them. The eggs hatch in about two days, and the larvæ, long, slender, caterpillar-like bodies, are very active, and live in what seem to be absolutely dry places. The sweepings of a room have been used to rear the young larvæ, in which case dust and their own excrement furnished sufficient food.

An infested pet animal may drop eggs enough to give rise to a small army of adults, if they are left undisturbed in carpeted rooms. In rooms constantly used, the ordinary sweeping will usually either remove the eggs or prevent their hatching.

The pet dog or cat should, therefore, be cared for first. There will then be little further trouble with *Pulex serraticeps;* although it is wise to let the pets have their special mat or cloth to lie upon, which may then be brushed often over the fire.

Floor cracks should be filled with plaster of Paris, that dust cannot collect and furnish food for this or other insects.

The ordinary insect remedies are of little use with this tiny athlete, robed in his black coat of mail, who is able to live upon dust, and who is said to be able to jump two hundred times its own height. If once they get a foothold, only strenuous methods are of any avail. Carpets must be taken up, steamed, or naphtha cleansed. Floors should be washed in hot soap-suds. Even if the carpet must be relaid, a thin coat of paint on the floor might prove an economical investment.

With some persons the bite of the flea brings on swelling and intense itching. Both may be allayed with salt water. The annoyance is severe but short.

Preventive Measures.—Care of the pet animals, washing and combing and general cleanness of their hair.

Remedies.—Thorough cleaning of the infested room, absence of dust collections.

Lessons IV and V

Insects Injurious to Food Supplies

Apparatus.—Borax, sulphur, molasses, chocolate, spices (clove, cinnamon, etc.); salt, plaster of Paris, water, proprietary remedies, a small mortar for grinding, spoons and dishes for mixing materials, spring-bottom can, materials stained with cockroach excrement, materials scented with the cockroach odor, fabrics or papers gnawed by cockroaches.

Cockroaches

Orthoptera — Blattidæ — *Periplaneta (orientalis, americana, and australasiœ) and Ectobia germanica.*—It is not strange that with the many conveniences and luxuries of modern houses there have come also some nuisances and pests. Some houses are as warm in winter as in summer, and too often bad air is an accompaniment of this heat. Hot air and water pipes running under and between walls and floors make many warm, dark, snug lurking places for insects. Perhaps the most common and offensive, in city houses at least, are the different varieties of cockroaches.

The roach family is one of the most ancient as well as the most numerous in the insect world. The moisture and warmth of the Carboniferous period especially favored the multiplication of all species, and similar conditions in the tropics to-day produce similar results. They have always infested ships, and are thus carried into all parts of the globe. Fortunately, however, for the housewife, most of the species live out-of-doors, feeding upon living vegetation.

The common species in this country are known by different names which are often used interchangeably, the "water bug" of one section being the cockroaches of a second, or the "black beetles" of a third.

There are two species easily distinguished by size and color. The black or very dark brown species is shiny and stout, the adult male with short, thin wings, the female nearly wingless; the other species varies from chocolate to a very light brown marked with lighter spots or bands on the back, near the head, and at the bases of the wings or their remnants. In all species the eyes are insignificant, the antennæ very long, the mouth parts suited to biting, and the legs to swift running or enormous leaps. They are more apt to trust to their legs than to their wings for safety. The segments of the abdomen overlap and may be greatly extended like an accordion, so that the body is rendered thin and flat, and capable of entering very small cracks.

The metamorphosis is direct, the larva and pupa resembling the adult, only smaller and minus wings. All stages are harmful. All species are very active, scudding rapidly away from the light or any interference.

The eggs are laid enclosed in an oval or bean-shaped capsule, with its surface marked into rings so that the whole resembles a row of small elliptical crackers placed face to face. This capsule is extruded from the abdomen of the mother, and is often carried by her, partly showing, for some time. All such capsules found should be burned.

The larvæ when hatched are white, but soon grow yellow and brownish black. Young roaches are usually seen in company with the adults, and it may be that they are cared for or brooded a little while after birth. If true, this is, perhaps, the one redeeming feature in the life history of an otherwise wholly disgusting insect. The black cockroach

certainly seems to enjoy the antics of his small progeny, for the little ones run over the parents, cuddle round them, or are carried by them with no sign of annoyance.

Almost any dead organic matter will furnish food for some or all the species of domestic roaches. Food supplies, fabrics, leather, paper,—all may be gnawed by these insects, and the damage done to books and clothing is often beyond repair.

The quantity of food supplies actually consumed, although by no means inconsiderable, might be overlooked, if these pests did not so often spoil whatever they come into contact with. They emit from their mouths and certain scent glands a dark colored fluid which stains their paths, and from which and their excrement as well, arises a fetid and disgusting odor. Shelves, boxes, drawers, and closets infested have to be washed with hot soap-suds or otherwise disinfected; clothing often carries the odor, and cooking utensils impart it, either as odor or taste, to food and drink.

To the initiated this odor often tells the tale of an infested house, when not a roach is seen, as in the case of a large, fashionable hotel where the warm-air ducts of the furnace betrayed the secret of a roach-infested cold-air box or cellar.

Roaches always seek the dark when disturbed, as if they knew their deeds were evil. They will even drop from ceiling to floor and scud among the shadows. From this habit grows the *first* rule for prevention of the pest.

Allow no cracks in warm, moist places, round sinks and water pipes, round tubs and baseboards, round chimneys and steam pipes. Fill them with putty or plaster of Paris, which may be painted over or colored to match the woodwork. A small crack is dark, holds dust and dirt which hold grease and moisture or food wastes, so that all such places act as invitations to roaches.

Second:—Keep all places which might harbor roaches dry and free from crumbs or food materials. A forgotten crust, a scrap of meat, grains of sugar, or drops of sweet liquids, may call an army that will overrun the house in search of food or breeding places.

Third:—Let in the light! sunshine wherever possible. Abolish the dark, damp sink cupboards, the dark closet. Where such places exist constant watchfulness is required, and this may not bring complete relief. Light, dryness, absence of food, and general cleanness will reduce the cockroach problem to its lowest terms.

Remedies are such or not according to conditions. The roaches are very wary and soon become accustomed to the methods used for their extermination, either avoiding them, if poison, or learning to ignore them, if only disagreeable. It is well, therefore, to surprise them occasionally by new methods.

Borax or insect powder should be scattered round sinks, tubs, or other favorite haunts. Insect powder may be burned on a hot stove or on a red-hot shovel. The smoke and odor produced in this way are often a more effective remedy than the dry powder. The room should be tightly closed for five or six hours in order to get the full benefit from the vapor. If this be done at night, more roaches are likely to be affected. Equal parts of borax and chocolate may be ground together. The mixture should be so well made that each bit of chocolate should have its bit of borax. The chocolate they like; the borax they dislike, although they soon learn to disregard its effects.

Plaster of Paris and common salt, in the proportion of one pound of the plaster to five ounces of salt, may be sprinkled round their haunts with good effect.

Powders interfere with their respiration by clogging the spiracles. The insects are rendered sluggish, and may

then be collected and burned. This is an effective method with the black beetle, who is so large, so plump, and so wary that he is killed with difficulty. This species is socially inclined and travels in companies. When conditions grow unfavorable or the battle is too heavy against them in one house, they often move *en masse* to the next. When never a cockroach has been visible for months, if a light be suddenly brought into the closed kitchen after some hours of darkness, there may be heard a ghostly scratching and scraping as a small army of black roaches scuttles away to seek hiding places. For such invasions the insect powder is best. Spread it generously over the floor at dusk and leave it there for hours or until dawn. Before the room is light sweep up and burn the powder and the stupefied roaches.

Sulphur and molasses mixed to a paste and spread on paper or chips scattered round their haunts usually drives them away quickly. Many of the insect exterminating pastes owe their value to phosphorus.

Advantage may be taken of their liking for sweet liquids by leaving such in shallow dishes, or with some means of approach provided so that they may be entrapped. Traps are effective in food closets when insect powder would be objectionable.

Preventive Measures.—Light, air, absence of food, cleanness, absence of cracks.

Remedies.—Insect powder, borax, chocolate and borax, spices and borax, sulphur and molasses, plaster of Paris and salt.

Ants and Miscellaneous Pests

Apparatus.—Molasses, syrup, lard, kerosene, boiling water, insect powder, small sponges, chips, strips of fur, small

dishes, spring-bottom can, atomizer or bulb syringe, dried beans, peas, whole spice or fruits showing the work of insects, wooden boxes or receptacles gnawed into by insects.

Lesson V

Ants

Hymenoptera — Formicidæ — *Monomorium pharaonis, Monomorium minutum, Tetramorium cæspitum.* — The ants, to many entomologists as well as to amateur observers, are the most interesting of all insects. Yet to the housewife they can be considered only as pests, except as she studies them individually.

In different parts of the country different species are more or less troublesome; but the tiny red ant is the one which seems to be thoroughly domestic in its tastes and habits. Besides this species a small and a large black ant are often troublesome in pantries and storerooms. The red ant is so tiny and agile that its destruction is difficult. None of the ants are destructive in so many ways or to so great a degree as other household pests, but they annoy by getting into food supplies and cooked food, especially the fats, sugars, and sweet liquids. The most distinctive characteristic of the ants is the constriction at the "waist," that is, between the second and last segments of the body. This enables the abdomen to be raised, lowered, or moved very quickly and forcibly. The wasp-like waist is seen occasionally on so-called higher animals to whom it does not properly belong. The metamorphosis is indirect, and most children are familiar with ants' larvæ and pupæ, which they wrongly call "ants' eggs." The real eggs are very small, and would not attract the attention of a casual observer even when visible to the unaided eye.

Ants are creatures wonderfully specialized according to work and form. Some have fully developed wings, some

have only the rudiments, while others bear no trace of such appendages. Most of the ants found in the house are the "workers," and do not have wings.

The antennæ are extremely delicate, slightly swollen at their tip, and seldom quiet. The mouth parts are formed for piercing the food substance and for drawing from it the liquid food.

The eggs are laid in enormous numbers and in several batches. The nests or *formicaries* hold large colonies made up of all forms so that they furnish most interesting and instructive objects for study. The adult form, however, is the harmful one.

To prevent attacks from ants, all fats and sweets should be tightly covered, — wooden buckets are not proof against them. Great care is necessary not to leave any grains of sugar or crumbs of food on shelves or floors. Cleanness and protection of all available food supplies are the first requisites for freedom from the ravages of any of these species.

Both of the black species usually establish their colonies out-of-doors, — the smaller one under stones in the yards or in holes in the fields, the larger one under the pavements. Unless the colonies are destroyed, the relief given by all other measures will be only temporary, for the females seldom leave the nests, and they start many colonies during one season.

The little red ant (*Monomorium pharaonis*) has its nest in the walls beneath the floors or in cracks behind the woodwork of the house. Thence the workers sally forth for supplies. When these are found, the news is quickly carried to the colony and swarms issue forth to feed and forage. By watching their movements the nests may often be located and destroyed by pouring in kerosene, or carbolic acid, or a boiling hot, strong solution of alum. Some-

times it is necessary to take up boards in the flooring. In some way the colonies should be located, if any one of these forms becomes a pest. They are persistent in retaining their homes, and the housewife must be as persistent as they are, if she hopes to keep them from the house or its vicinity.

Pastry is a delicious titbit for the little red ant, and many a woman has first found out their presence by seeing them appear upon the pie she was serving for dessert.

Shelves may be washed with a five per cent carbolic acid solution, with a decoction of quassia chips, or hot alum water. Powdered lime or borax sprinkled freely on shelves and floors may be effective. Certain strong odors are objectionable to the red ant especially. Wormwood, cucumber, or pennyroyal are used for this purpose. Cucumber parings, the fresh herbs, or the oil of pennyroyal may be used. The last may be spread about on bits of cotton.

Lard is an attractive bait. Chips holding lard may be placed in the infested places; the little creatures will swarm over these, and when they are well covered they should be thrown into the fire. A strip of fur placed along the shelf or round plates of food is a protection, for the ants get entangled among the hairs. Plunge the infested fur into boiling water and thoroughly dry afterwards.

The black ants have so strong a liking for sweets that these furnish the best bait for them. Saturate small bits of sponge with syrup, molasses, or a solution of borax and sugar. Leave them about the places most frequented by the ants. When these are well stocked, plunge into boiling water as before.

Preventive Measures. — Covering, or tight closing, of food supplies, especially fats and sugars; cleanness and dryness; absence of all attractive substances.

Remedies. — Boiling water, carbolic acid, alum, traps, fur, borax, wormwood, quassia, pennyroyal, cucumber.

Miscellaneous Pests. — The number of insects which may be found in pantries and storerooms is almost infinite. Some of these affect only moist food supplies like meats, pickles, cheese, etc.; others are found in meals, prepared cereals, spices, legumes, and dried fruits. Many times these food materials become infested in the mills or storehouses; others in the groceries or markets; while others may become so through lack of proper care in the individual house.

All supplies should be examined carefully when bought. When meals, flours, crackers, dry fruits, or prepared cereals show silken threads or traces of webs or insects either at first sight or after sifting, — all such suspicious supplies should be returned to the store. If the nuisance continues, another source of supply should be sought.

Persons in charge of mills and storehouses should understand the dangers to their products and the preventive and remedial measures. If there is carelessness here, the intermediate dealer should return all infested products; and the honest, enterprising grocer or marketman will see to it that *his* goods are not contaminated while in his possession.

Supplies, non-infested when bought, become so very soon if pantries and store-closets are not kept cool and dry. Moisture and warmth are the favorable conditions for most insect development. Wooden receptacles may harbor eggs or larvæ for long periods within their seams or crevices; larvæ may enter such, or eat through pasteboard, or through paper bags. Glass, tin, stone, or earthen receptacles are safer for the storage of any food materials. Such food-holders in cool, dry rooms will reduce to the minimum all danger from insect pests.

Where wooden buckets or barrels must be used, a coat of

paint outside serves as a protection; but nothing can take the place of dryness and constant cleanness.

Here, as well as in other parts of the house, and with all insects, especial watchfulness should be exercised in the early spring months that no hibernating adults or developing pupæ spread infestation while the housewife is off guard.

Lessons VI and VII

Insects Injurious to Clothing or Fabrics — Clothes Moths and Silverfish

Apparatus. — Insect powder, naphtha, "moth balls" or other "exterminators," camphor, black pepper, cedar chips, tarred paper, pasteboard boxes to illustrate sealing, paper, mucilage or paste, water, paper bags, cotton bags (pillow slips), newspapers, twine, needle and thread, fur, steel comb, woollen stuffs to be cleaned and packed, rattan or flexible wand, hot flatiron, clothes for steaming.

Clothes Moths

Lepidoptera — Heterocera — *Tinea*, *Tineola*, and Others. — There are different species of these insects which infest different sections of the country. In the colder portions and in country houses their ravages are confined to the summer season; but in the warmer parts and in cities, where houses are kept at summer temperature throughout the year, their ravages may continue indefinitely.

The adult insect is small, yellowish, or buff-colored, with two pairs of delicate wings, the forward pair darker than the other, either with or without spots or distinctive markings. The most common species has dark spots along the bases of hairs which fringe the edges of the wings, and detached spots near the forward edge. The antennæ are long,

slender, and tapering. The head looks like a small cushion with hairs for pins.

With spread wings the moth measures little more than half an inch. They are averse to light, and fly around the darker parts of the room. This habit with the smaller size serves to distinguish between them and those varieties which fly round lights and often burn themselves to death in the flames. The metamorphosis of these moths is indirect.

The adult or imago is harmful only because it lays the eggs, for its mouth parts are fitted for lapping, and it must, therefore, take liquid food. The pupa takes no food, so that the harm is done by the larva, and this begins to eat as soon as it leaves the egg. When seen flying round the house, the moth or "miller" is either seeking a suitable place to deposit her eggs or has just deposited them, and is, perhaps, taking its last flight, for they die very soon after they have laid their eggs.

The mother moth cannot be accused of neglect, for she invariably selects those materials and those parts of the materials which will furnish the richest supply of warmth and necessary food for the tiny babies. She also scatters them here and there, not depositing them in one place; thus ensuring each larva sufficient room to get its food and clothing.

Some varieties prefer to bring up their babies upon wool, others choose hair or fur or feathers; but if they cannot get their first choice, they will accommodate themselves to circumstances, and find their food among any or all of the above substances. Possibly they may sometimes vary their diet with silk or paper, but this is not common, and cotton they have not yet deigned to add to their already generous bill of fare.

The mother moth is instinctively wise. She not only chooses the best materials for food, but also knows that

folds, gathers, and creases collect and hold dust, absorb vapors from cooking, from fires and lights, and that such places are least likely to be thoroughly and often cleaned. Such places are the chosen nurseries — the gathers in woollen dress-skirts; the collars and folds and under-arm spaces of coats and waists; the seams and creases in trousers, where mingled dust, perspiration, and grease stock the larder.

The eggs of all species are nearly or quite invisible to the naked eye, and are usually laid directly upon the material which will serve as food, but sometimes in crevices and cracks of trunks, boxes, floors, or in empty nail-holes where the tiny larvæ may readily gain access to the food materials.

The larva, called worm rather than caterpillar, is whitish in color with a dark head. As soon as hatched, the common species builds for itself a cylindrical jacket or case out of the materials upon which it finds itself. This is its first work. The outside of the jacket is therefore the same in color as the food material, but the inside is lined with soft, whitish silk. The lava thus eats paths along the cloth, or in some cases burrows directly through the goods, burying itself in the tunnels of fuzzy pile. They are sometimes found outside of their cases, although, usually, only the brownish head and next segment of the body are visible.

As the body grows it requires a larger jacket or case, and the larva cuts a slit and inserts a gusset or gore to increase the diameter, besides increasing the length. If different colored cloths furnish the food during the larval stage, the jacket may become a Joseph's coat of many colors. When rearing the larvæ for examination, this is a pleasing experiment to try.

In dealing with moths as with all harmful or disagreeable pests, "Prevention is better than cure."

It is easier to prevent the entrance of the parent than to

kill the eggs, or the larvæ, or to remedy the ravages. The preventive measures include: early screening of windows and doors, for the moths usually deposit their eggs in April or May (some species raise two broods, the latter one in August or September); plenty of sunlight and fresh air throughout the house; light closets, and these often aired and kept free from dust and fluff; absence of heavy carpets which cover the entire floor and are fastened close to the wall, as these gather dust, are hard to keep clean, and will not be removed and aired as often as is desirable; as few articles or stuffs as possible that are food for these forms. The *too many* pieces with unused or unusable garments, which often fill trunks and drawers would better be destroyed, given away, or used, than stored, thus inviting moths and final waste.

Articles which must be stored should first be thoroughly cleaned. Any article which can be washed should be. All grease spots must be removed, and dust beaten or shaken out. Woollen stuffs and furs should be hung out-of-doors in the sun and wind; beaten with a small rattan or other flexible stick, — furs may be combed with a steel comb, — and thoroughly brushed. All this is necessary to insure the absence of eggs. If all eggs are not removed before storage in warm, dry, dark places, there is no safety. The eggs will hatch, and the larvæ have nothing to interfere with their feast.

Strong odors generally repel moths. Perhaps the odors themselves are disagreeable, or perhaps they cover up the natural odor of the stuff, which, to the insect, is an invitation to come in and establish its family. This fact explains why camphor, cedar, pepper, tar, "moth balls," and other preparations are recommended for the protection of woollen goods and furs. Such substances may prevent the mother from entering, but do not kill the eggs, which may have been

laid on or in the articles or packages. All such substances lose their strong odor after a while and become useless.

Moth eggs will not hatch if kept very cold. A constant temperature of 40° F. will prevent all ravages from moths. Cold storage warehouses are often kept as low as 25° F., so that articles stored there may be kept safely any length of time. The assurance of safety is worth the additional expense, where many or valuable articles are to be preserved.

If a light, airy room or closet can be spared, dresses, coats, furs, blankets, etc., may be hung or left loosely on shelves, if examined, shaken, and brushed every month or oftener, according to conditions. They are much safer than when put away in dark, close packages, subject to wrinkles. Turpentine, camphor, tobacco, or other strong-smelling substances may be sprinkled or spread on floors or left in an open bottle in the room near the doors or other places where moths might enter.

If clothing must be left undisturbed, the thorough cleaning of every article may be followed by packing it smoothly in boxes, bags, bundles, etc., with any preferred substance to furnish the disagreeable odor. The latter is not necessary if the enclosing receptacles are absolutely sealed against the moth. Boxes may have strips of paper pasted over the crack between cover and box. Paper bags should have the tops turned over and pasted down; cloth bags must have the open mouth turned under and sewed securely. They should also be made of cotton. Packages may be wrapped in cotton or newspapers with no crack or broken place where this extremely thin little insect may enter. Trunks, closets, drawers, or boxes may be sprayed with naphtha or turpentine.

Naphtha, benzine, turpentine, kill both eggs and moths, therefore these are both preventives and remedies. The

extreme inflammability of their vapors is the chief argument against their use. They must not be used where there is any fire or flame, or where there will be such for some time. Woollen garments may be cleaned with naphtha, carpets and furniture may be sprayed or saturated with it. If the work be done out-of-doors and the stuffs left until no odor is perceptible, there seems to be no better remedy. Turpentine does not evaporate as quickly as naphtha, and both odors may be detected from furniture in a warm room for a long time after the process of cleaning.

When the edges of carpets are infested, the tacks may be taken out, the carpet turned over for some inches, folds of wet cloth laid under and over the carpet strip, and hot flatirons applied. The steam will penetrate and kill larvæ and eggs.

Kerosene, naphtha, or turpentine may be sprayed or poured along the edges or into cracks at such times as may be safe from fire. Black pepper and insect powder kept along the edges may prevent the deposition of eggs.

The safest and surest methods of dealing with the moth pest are the methods of prevention. It is very difficult to know that all eggs are absent, when once they have been present.

When a house is to be closed for the summer, pans of water should be left in the centre of the floors. Moths and other insects will go here for water and may be caught. Evaporation, for much longer periods, may be prevented by spraying a thin film of some inodorous oil over the surface.

The methods of fumigation used in houses where contagious diseases have occurred also exterminate moths.

Preventive Measures. — Light, sunshine if possible, air, absence of breeding places, cleanness in house and of clothing, cold storage, frequent examination, movement and use, strong odors.

Remedies. — Brushing, beating, and combing, steam, kerosene, naphtha, turpentine, fumigation.

Silverfish

Thysanura — Lepismatidæ — ***Lepisma.*** — In old houses, in attics, and sometimes in the closets of any house is seen a pretty, slender, agile insect, popularly called silverfish, because of its color, its scales, and undulatory movements. Other names are "sugar-fish," "fish-moth," "silverwitch," and "thistletail."

The scales are smooth and slippery, the body is wingless and worm-like in appearance, about one-third of an inch long. The head bears two long slender antennæ, while the anal end carries three long, barbed bristles, one extended in line with the body, the others, one on each side, sometimes at right angles to the first.

The silverfish seems to have a voracious appetite for lace curtains, holland shades, and all starched goods. It attacks books, silks, and wall-paper, probably to get at the sizing or paste which they supply, and it occasionally tastes the food supplies. The most damage is done when a furnished house is closed for the summer or for a longer time. Fabrics in use and, therefore, often disturbed are least subject to injury.

No special preventive measures apply to this insect.

All specimens seen should be killed, and fabrics packed away should be often examined and shaken. Insect powder may be scattered freely under and about trunks, packing-boxes, and shelves, while bookcases should also have a generous supply.

The appetite for starch which the silverfish shows should not be catered to by putting stored fabrics away in a starched condition.

Preventive Measures. — Frequent examination of stored fabrics, dryness in trunks and any receptacles for stored fabrics.

Remedies. — Insect powder.

Carpet-beetles and Crickets

Apparatus. — Insect powder, naphtha, turpentine, kerosene, tarred roofing paper, water, specimens of fabrics eaten by carpet-beetles, specimens of cloth eaten by crickets, atomizer or syringe, spring-bottom can, trap bated with sweet liquid for crickets, hot flatiron, cloths for steaming, pieces of carpet to illustrate steaming.

Lesson VII

Carpet-beetles

Coleoptera — Dermestidæ — *Anthrenus Scrophulariæ*. — During the last twenty-five years great havoc has been caused in some parts of the United States by an insect pest, familiarly called "buffalo bug," or "buffalo moth." It is neither a bug nor a moth, but a beetle, and, like the moths, it is the larvæ which eat carpets and other fabrics. It is said to have been called "buffalo beetle" when it was first found injuring carpets in the city of Buffalo, in 1872.

It is found most frequently in the late spring, in the summer, and fall months, for cold or lack of food retards its development. It is, however, very persistent of life, and may exist for months in unoccupied houses, without food, except that furnished by the dusty lint and fluff which are never absent. Like the moth, it prefers wool, but will riddle silk, and often attacks books, either for the paste and glue used in their binding, or for the binding itself.

The common species is a small beetle, nearly elliptical, or broadly oval in shape, covered on the back with minute

scales which give it a black and white appearance. There are more or less distinct blotches of red caused by a stripe down the middle of the back, which widens in three places along its course. It plays "possum" when disturbed.

The head is scarcely distinguishable from the body except by the short knobbed antennæ. Each leg ends in a tiny hook.

The metamorphosis is indirect.

The larva is longer than the adult, with the plainly segmented body tapering towards the anal end. Each segment has a tuft of stiff brown hairs on each side, while on the back a larger tuft of longer hairs finishes the body at each end. The larva is very active, eats voraciously, and is usually found covered with the fuzz of the material upon which it is feeding. This fuzzy, hairy appearance might well gain for it its name of "buffalo." The larvæ do not cling to the cloth as do the larvæ of moths, and the eggs are always laid in dark places.

Under favorable conditions the larva changes into the pupa quite rapidly. The adults are day-fliers, and as soon as the pupal skin is cast they try to leave the house to reach certain plants whose pollen is their favorite food. *Scrophulariaceæ* and some *Compositæ* are often chosen, but the white spiræas are their especial delight. All specimens found upon such plants should be killed, for they will probably go into houses to lay their eggs.

Where the beetles work in carpets, they sometimes eat irregular holes here and there from the under side, and sometimes follow the cracks, cutting long slits. In folded garments they eat small round holes through all the folds. A folded silk umbrella was found with tiny holes each side of every rib, and the guilty larva dropped when the umbrella was raised.

As with moths, so with this pest, all-over carpets are

especially favorable lodging, feeding, and breeding places, because of the dirt there preserved, and because they are not shaken, beaten, and aired sufficiently often. Stuffs which are examined and shaken may be kept from their ravages, because the larvæ are not attached to the fibres.

Preventive measures are identical with those for moths.

In storerooms and attics where many woollen goods are kept it is sometimes feasible to spread for the beetles a special table! One ingenious housekeeper used to lay a strip of *red* flannel on her attic floor and daily shake it over the fire or plunge it into a pan of boiling water. In this way she protected valuable property. They seemed to like red better than any other color.

It is, perhaps, the worst enemy of woollen stuffs, and where once established requires the most vigorous and persistent efforts before it can be eradicated. If its occurrence leads the American housewife to discard her all-over carpets, it may be looked upon as a blessing in disguise. In Europe, its original home, it is not considered a general household pest, probably because bare floors and rugs are the rule, rather than the exception.

If carpets must be retained where this pest has shown itself, they should be thoroughly beaten, and naphtha cleansed; the floors washed with strong, hot soap-suds, or sprayed with kerosene, benzine, or turpentine; all cracks filled with plaster of Paris, the edges, better the entire floor, covered with tarred roofing paper before the carpet is relaid.

Another beetle has been found to eat carpets, woollen stuffs, feathers, and books. In some places it has given more trouble than the previous form, but in general fewer complaints are made about it. It may occur in the same places and under the same conditions as the other. The adult (*Attagenus piceus*) is smooth and black, smaller and

more oblong in shape; the larva is long, slim, light brown, with its narrower body tapering toward the anal end which bears a wisp of long, slender hairs. It, too, has hairs over the sides and back, but they are more flexible and closely appressed to the body. Its habits and work resemble those of the previous species, and the same measures of prevention and extermination apply. This, however, usually works equally well during all seasons, while the "buffalo bug" works its greatest damage during the summer months.

At the risk of killing a few innocent species, it will be well to destroy every small, black, or black and white beetle found in the house. The "lady-bird" saves herself from this general slaughter by the red color of her coat, and her gay, prominent spots. She feeds upon plant aphides, and should be spared.

Preventive Measures. — All given for moths, especially emphasized.

Remedies. — Same as for moths, more persistently applied.

Crickets

Orthoptera — Gryllidæ — *Gryllus*. — In country houses the cricket on the hearth may become the cricket in the laundry basket, the bureau drawers, or closets, and it may meet its death in the uncovered dish of liquid from which it took its last draught. It prefers liquid food, but that failing, it finds other pantry supplies decidedly to its taste. If these be not at hand, it does not hesitate to attack clothing, whether from hunger, or simply to keep its jaws moving, it is hard to tell. Perhaps the most harm comes to the basket of damp clothes awaiting the laundress, for there the cricket finds a convenient source of moisture. The common grasshopper, too, will, if detained in the house, dine on the housewife's possessions.

The cricket cannot become a serious household pest so long as it does not breed there, but always in the fields. It is well to be on the watch, however, for some enterprising individual cricket may decide to change its habits, and become an in-doors insect. The metamorphosis is direct.

The adults are large, nearly or quite black insects, with long, threadlike antennæ extending from the large, smooth head. The hind legs have strongly developed muscles, which enable the insect to take quick, long leaps. This is more often its method of escape than by the use of its wings, although these are long, and well developed. The feet are furnished with prongs, which enable the insect to hold quite tightly to any fabric. Its characteristic love song is made by movements of one wing over the other. Its mouth parts are suitable for biting, and they use them as a means of defence when captured by hand.

Cricket is so plump, so merry, and altogether so interesting that one hesitates to kill it. Yet, if it becomes a pest, it should be exterminated. Its desire for moisture and sweet liquids may become its ruin, and such substances may serve as traps for Mr. Gryllus.

Ancient superstitions still cling about this black singer, and many persons still believe that if a cricket be killed, its relatives will avenge the murder by destroying the clothes of the murderer. It is easier to kill crickets than superstitions.

Preventive measures may be included in one word — watchfulness; remedies can scarcely stop short of actual death.

Suggestions for Related Language and Reading Lessons. — Encourage observation of insects in field and garden — especially ants, beetles, and bees. Require written descriptions of the results of such observations.

Written descriptions of typical insects. Compare with authoritative descriptions in books.

Keep list of insects observed and studied.

Note adaptations of structure to habits of life — flattened bodies in insects choosing cracks as hiding places; color and markings like substances preferred for food, etc.

Written description of the above in the form of essays, to cultivate accuracy of statement, and in form of stories or dialogues between insects and carpenters, etc., for the exercise of the imagination.

Calculate damage to property, actual or estimated, due to lack of care. Compare this with actual or estimated expense of preventive or remedial measure. Draw up balance sheet.

Select from Bibliography books or selections most appropriate for grade and work. Read, and have written reviews of matter read — condensed or expanded account of same.

Search through general literature, prose and poetry, for references to insects, — their habits, work, treatment; for figures of speech drawn from the general subject, as: Prov. xxxi. 27, first clause; Prov. vi. 6.

> A close mouth catches no flies. — CERVANTES.
>
> Maidens, like moths, are ever caught by glare. — BYRON.
>
> And half-starved spiders prey'd on half-starved flies.
> — CHURCHILL.
>
> Here Skugg lies snug
> As a bug in a rug. — B. FRANKLIN.
>
> Like summer friends,
> Flies of estate and sunneshine.
> — GEO. HERBERT.
>
> A worm is in the bud of youth,
> And at the root of age. — COWPER.

A fly bit the bare pate of a bald man, who, in endeavoring to crush it, gave himself a hard slap. Then said the fly, jeeringly, "You

wanted to revenge the sting of a tiny insect with death; what will you do to yourself who have added insult to injury?" — PHÆDRUS.

What is not good for the swarm is not good for the bee. Everything is in a state of metamorphosis. — MARCUS AURELIUS.

Solon used to say that . . . laws were like cobwebs.

And others more or less familiar.

Let pupils originate figures of speech founded upon insects' structure, habits, etc. Class criticise, improve, if possible. Have notebooks in which above figures of speech, whether quoted or original, may be kept.

CHAPTER XIV

HOUSE CLEANING

By L. L. W. WILSON, Ph.D.,

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Facts. — The best advice that can be given on the subject of house cleaning is *"Don't,"* or, if you must, then clean twice, once in the spring and again in the fall.

The annual spring cleaning not only upsets both the cleaners and the cleaned, but, occurring just at the time when insects are laying their eggs, is apt to spread the disease, rather than to cure it. By waiting until midsummer, more will be accomplished, even if no better methods are employed.

The chief advantage of house cleaning lies in the fact that at this time the year's accumulations are looked over, and many of them rejected. To leave woodwork and floors and closets for a yearly cleaning, as many people do, is inexcusable. Once a week in dusty regions, or, perhaps, once a month in the clean country or seashore, is little enough.

In general the same methods should be pursued in cleaning at house cleaning time as in the weekly cleaning. For this see the chapter on the Dining Room, and the section on cleaning in the chapter on the Kitchen. In addition to this, remember that all closets must be cleaned in connection with rooms to which they belong, but before that room is touched.

If there are carpets, each must be taken up, and either sent to a carpet cleaning establishment, or else, one at a time, taken into the yard, beaten, sprayed with benzine, and allowed to air for several hours.

In the meantime, the room must be thoroughly swept and dusted. If there are cracks in the floor, or at the junction of the baseboard and floor, clean them out, pour benzine into them, and later fill them with liquid plaster of Paris.

Shake thoroughly in the yard all hangings. Put these away, rough drying any soiled wash curtains. Cover the pictures with netting, and the cleaned furniture with linen.

Method. — Make this season of the year the occasion to review the whole subject of cleaning. Since they have already had demonstrations of the principles involved, this will be most satisfactorily done in a series of oral language lessons. For practical work let them consider the problem of effectively cleaning the schoolroom. Make a list of what is to be done, and the order of doing. Let the children themselves choose a leader, who shall have absolute power to carry the cleaning through.

JUNE

MENDING AND SEWING

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CHAPTER XV

MENDING

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The lessons as here outlined are supposed to give the child a slight insight into the art of mending, so that she may be able to practically apply it later at home.

The study of the history of the materials used will be found to enhance the interest of the child in her work, at the same time adding wonderfully to her fund of knowledge.

The one suggestion to be made to the teacher is to make the work practical as well as educational. This can be done by applying it always to the home needs, and illustrating the point at the same time.

In presenting a lesson to a class, the demonstration frame in many cases is most valuable, and should be used, if possible.

History of Sewing

Sewing has existed in every state of society. At first thorns were used as needles, or fibres of plants, to bind the foliage, used as covering, together. Later, as garments were made of skin before woven cloth was manufactured, some nations used small bones of fish or animals, sharpened at the end, as needles, and twisted sinews for thread.

The Egyptians were the first to manufacture cotton cloth, and the garments found in the tombs show that at an early period they were expert with their needle in a primitive way, both in sewing and embroidery.

Five thousand years ago the Egyptians used needles made of wood. Pins were first made of ivory, afterward of box-wood, bone, and some few of silver. In 1543 the manufacture of brass pins was begun, and at the present time the English pins rank the highest in the market.

Needles were first made in England by a native of India, in 1545, but the art was lost at his death. It was afterwards recovered by Christopher Greening, in 1560.

The women of Greenland sew very well, using sinews of seal, whales, and reindeer for thread, which the girls are taught to prepare at an early age.

The women of Corea sew neatly, but very deliberately. The French, as a nation, excel in their fine hand needle-work. The children are taught to sew when very young, and in the schools sewing is made part of their education.

In Switzerland needlework, mending, etc., has been taught the girls in the schools for many years. The Japanese and the Persians are noted rather as embroiderers than sewers, the work being done more often by the men than the women.

Naturally the sewing done at first was primitive, and the garments made were very simple; but as time advanced,

almost every nation improved in sewing and garment cutting, and also in embroidery, so that by the end of the seventeenth century the use of the needle in convents and schools was carried to great perfection.

Hand sewing continued to be the only means of sewing until 1830, when Bartholemy Thimonier of France invented the first sewing-machine. This, of course, was a very simple affair, and was followed by a double thread, or lockstitch, machine, invented by Walter Hunt of New York in 1832. In 1844 Elias Howe of Massachusetts improved upon those already invented, and the Singer sewing-machine was first used in 1851. These, as is well known, have been improved upon by many others, until it would seem perfection had almost been reached.

Sewing has been introduced as part of a child's education in most of the public schools of America in the past ten or twelve years, and will soon, it is hoped, become universal.

Study of Material

Wool. — Wool, in its natural state, is a dirty white, yellow, or brown in color, and is obtained from the sheep. The sheep are shorn once a year, generally in April or May, the best wool coming from the shoulders, lower part of the neck, and the back.

When seen through a microscope, a fibre of wool is composed of rings, which stand out like scales on a fish, and it is this property which makes a piece of woollen cloth feel rough to the touch when passing over it in one direction, but not in another. Woollens and worsteds are very much alike, but it may be easy to remember that long-fibred wool, when spun and woven, produces worsteds, while short-fibred wool, spun and more closely woven, makes the wools, though it is

now hard to distinguish the difference, owing to the great improvement of the machinery used in the manufacture.

The first process in the preparation of wool for weaving is the washing. This is done by a machine which opens out the matted wool by means of rakes, at the same time washing it through several waters on a series of tables.

The next step is the bleaching of the wool, which is not difficult, and far less laborious than the bleaching of cotton or linen. If the wool is to be dyed a dark color it is not bleached.

The use of wool for spinning and weaving is of so great an antiquity that it is impossible to say when it originated, but it is certain that wool was in use long before vegetable fibre was employed.

Our greatest supplies of wool come from California and Australia. London and Boston are the greatest wool markets in the world.

Cotton. — Most of the cotton used in the world is raised in the United States, and the two principal varieties are, short staple cotton, or cotton having short fibres, and long staple cotton, having long fibres. The Sea Island cotton, which has the longest fibres, and is the best, is almost extinct.

Cotton grows in warm climates, and the seed is sown in March or April, and early in June the plant begins to bloom. The blossom resembles the hollyhock, and changes its color in twenty-four hours from pale straw color to a clear pink. After the flowers fall the pods, or bolls, grow rapidly, and burst open when ripe, showing the fleecy cotton ready for picking.

After the cotton is gathered it is exposed to the sun until quite dry, and the seeds are separated from the fibres of the cotton. The fibres are next separated from each other, and freed from dust as nearly as possible.

It is now in the form of a very clean, light, downy sub-

stance, but the fibre is not parallel. To effect this it is carded or combed straight. After the carding the cotton leaves the carding engine in a small, delicate roll called a "sliver, which has to be changed into rovings," or still more delicate threads, which are so thin that they have a slight twist given them, which converts them into a loose kind of spongy thread, which is spun into yarn. In making thread the yarn is doubled and twisted more than for weaving into cloth, as greater strength is required. It is washed. bleached, dyed, and reeled on to bobbins, and finally spooled. In spooling, after the machine tender has set the spool on the spindle, and attached the end of the thread from the bobbin, the machine does the rest. It runs on evenly, just two hundred yards, and at the right time and place cuts the fine slit in the edge of the spool, fastens the thread in it, cuts it off, and drops it in a tray, after which the spools are labelled and packed.

When the yarn is to be woven into cotton cloth, there are many intermediate steps to be taken after the spinning is completed, such as dressing, beaming, winding, and warping.

Besides the dressing, there are many curious machines employed to prepare the yarn for the loom, and many of these operations are nearly alike in all the manufacture of textiles, whether cotton, wool, silk, or linen.

The yarn for the warp and woof threads are prepared on different machines, the warp thread being made the stronger, as it is subject to a greater strain.

White cotton cloth is bleached after weaving.

Flax. — The linen cloth and linen thread we have is made from flax, which in turn is gotten from the flax plant.

This plant is from twenty to forty inches high, with long, narrow leaves branching only at the top, with bright blue flowers. The seeds of the flax are known as linseed, and are much used for oil.

The stalks are to be pulled before the capsules are quite ripe, when the stalks of the plant have become yellow, and are about two-thirds their height. The stalks are pulled from the roots, not cut; the seeds are then separated from the stalks, and the stalks are sunk in water and kept down by weights, as nothing is lighter than flax, until the fibre, which is to be used, is partly separated from the woody core. It is then taken out, and by a method known as scutching the fibre is entirely freed.

The spinning and weaving is the same as for cotton.

Needles. — The needle, though a simple instrument, has, in its manufacture, to pass through the hands of nearly a hundred workmen. It is made from steel wire, and the processes through which it has to pass are as follows: 1st, cutting the wire; 2d, straightening; 3d, pointing; 4th, eying; 5th, hardening; 6th, cleaning; 7th, counting and packing.

In the first step, or the cutting of the wire, the wire is cut in pieces the length of two needles, wires of equal diameters being selected, so the needles will be all of one size. These lengths, having been cut from coils of wire, are, of course, all more or less bent, and have to be straightened, which is the second step. This is done by enclosing them within two rings, which are heated to redness. The edges of the rings are inserted in what is called a smooth file, and the rings held in this are rolled backward and forward until, by their friction against each other, the wires become perfectly straight.

They are then pointed at each end in a pointing machine, which simply requires the feeding of the wires in a little trough. In their almost momentary stay in the machine, during which they are made to rotate on a centre-hollowed stone, they are pointed precisely as if done by hand.

We now have a wire pointed at each end, or two needles

joined together, ready for the eyes, or holes for the thread. The eyes are now punched in by a stamping machine, and the needles are broken in two.

They are next hardened by being brought to a red heat and then placed in cold water or oil, heated again, and gradually cooled. When they change to a blue color they are properly tempered.

As the needles are now in a very dirty state, they are cleaned by being put in heaps in canvas, and rolled into bundles, and put in a scouring machine with soft soap, emery, and oil, where they are rolled back and forth for fifty or sixty hours.

When taken out they are sorted, so as to have the heads all one way. This is done by girls, who wrap wash leather around the fore fingers of their hands, and, pressing them against the pile of needles, catch all the points.

As a last touch, the needles are rubbed between chamois leather to remove any stains which may have been left, and are then ready to pack.

They are counted, and put into papers chemically prepared, which prevents the needles from rusting. An expert can count and paper three thousand needles in an hour.

The largest needle factory is in Redditch, England.

The Thimble. — Thimbles are made of metals, such as gold, silver, steel, brass, aluminum, and celluloid.

The metal from which the thimble is to be made is rolled in thin sheets, and cut into round disks, which are put upon a die, and made to take the shape of a thimble. The edge is then turned up, and the small indentations are made by machinery upon the top and halfway down the sides, which catch the needle when used in sewing. They are tempered by heating and cooling, very much as the needles are. Most of the ornamentation upon common thimbles is done by machinery, though the finer thimbles are hand engraven.

Some thimbles are made without a top, and are used chiefly by tailors; while sailors use only a broad ring, with flat indentations on one side, and wear it on the thumb, instead of the middle finger.

Lesson I

Facts

Correct Position. — The child should sit erect and well back in the chair, and hold her work up but not too near the eyes.

Threading the Needle. — (1) Measure the length of thread from shoulder to shoulder. (2) Break the thread from the spool. (3) Hold the needle, a little below the eye, between the thumb and first finger of the left hand. (4) Hold the thread in the right hand and bring the hands together, thumbs touching, at the same time pulling the thread through the eye of the needle.

Making a Knot. — Twist the end of the thread once and a half times around the top of the first finger of the left hand, roll the end under with the thumb, and secure the knot by pulling it down with the thumb nail.

Taking a Stitch. — Hold the needle up to the thimble, — make a stitch. Draw the thread through with the thread over the little finger.

Holding Scissors. — Scissors should be held in the right hand with thumb and middle finger through the handles and pointed blade down. In cutting straight lines, the blades should be opened wide and brought together with one movement until the tips almost meet, and in repeating the movement care should be taken to have the line continuous and not jagged.

Method. — For these lessons in mending, each child will need a bag in which to keep her utensils and her work. It

is not a bad plan to show them one of a suitable size and, giving them the material, let each make her own before the lessons begin. For, after all, experience is an excellent teacher, and having made an effort, they will be the readier to learn a "better way."

In the bag they will need a small needle case, a pincushion, scissors, thimble, and thread.

All the work outlined in this lesson should be done as a drill, that is to say by count. The teacher, of course, increases the rapidity of the count as they become more expert.

Drill for opening Bags

1. Open bag.
2. Take out work.
3. Arrange it on the desk.

Drill for closing Bags

1. Put away the needle.
2. Fold up the work.
3. Put it away in the bag.
4. Hold up bag.
5. Collect.

Drill for threading the Needle

1. Measure the thread.
2. Break it from the spool.
3. Hold needle in the left hand.
4. Hold thread in the right hand.
5. Bring the hands together.
6. Pull the thread through and over.
7. Knot.

Drill for taking a Stitch.

1. Hold the needle up to the thimble.
2. Make a stitch.
3. Draw the thread through.

Lesson II

Basting

Materials. — Muslin, 70 cotton, No. 9 needles.

Facts. — Uneven basting (Ill. *A*); even basting (Ill. *B*).

These two drawings show plainly what is meant by basting, and also the two kinds. In uneven basting the

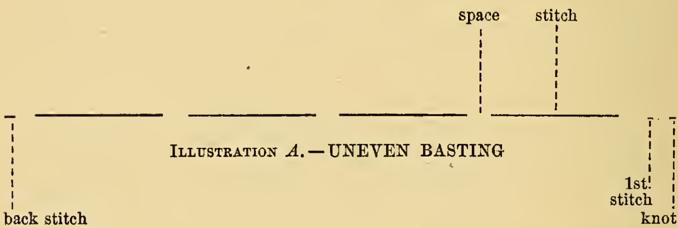

Illustration *A.* — UNEVEN BASTING

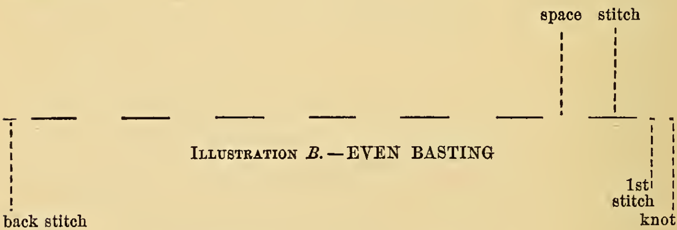

Illustration *B.* — EVEN BASTING

stitches are about three-quarters of an inch, and the space one-eighth of an inch. In even basting both the stitch and the space are one-quarter of an inch long.

In teaching this and all succeeding lessons, provide the class with samples. This should be individual, if possible. This means a good deal of labor, but each might be used many times.

By all means use the blackboard.

A large piece of material and worsted of a contrasting color will demonstrate all the stitches.

Let the children themselves discover the knot, the short stitch immediately following the knot, the long stitches and short spaces (how long?), and the back stitch at the end. What is the advantage of a very short stitch at the beginning? Why is it finished with a back stitch?

Show them with the worsted and cloth how to take each of these stitches. Show them the proper method of holding the muslin (over the first two fingers of the left hand). Let them baste.

Show them samples of even basting. Let them compare the two. What is the difference? What is the advantage of even basting? (Greater security.) Of uneven basting? (Greater speed.)

Give them the opportunity to practise.

Lesson III

Hemming

Facts. — For hemming, the cloth is folded twice, the width of each turn depending upon the material and the object of the hem. For practice hemming in school, the first turn should be one-quarter inch and the second one inch. The cloth should be turned and then carefully basted with the stitches close to the lower edge of the fold. The needle is pushed through the fold of the hem, slanting toward the left. Draw the needle through, leaving about

one-half inch of the thread still through the muslin (Ill. *C*). The second and third stitches, also, are taken only through the fold of the hem, but the needle slants toward the right (Ill. *D*). All the remaining stitches are taken through the three thicknesses of the material with the needle slanting toward the right. These stitches must be perfectly even.

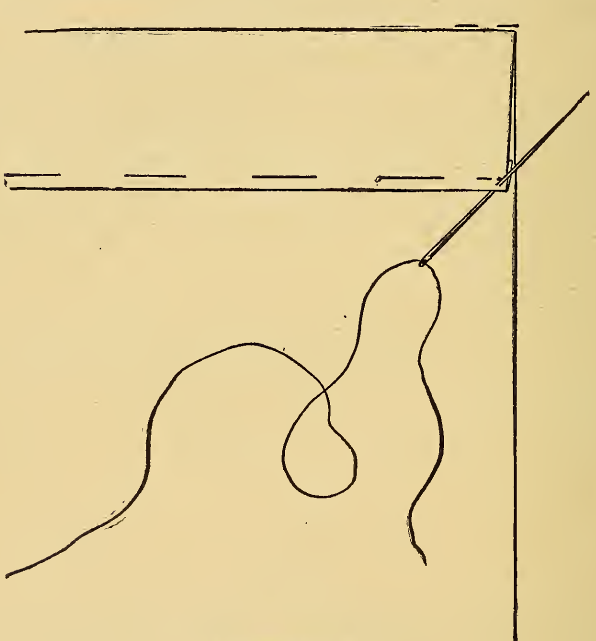

ILLUSTRATION *C*

The muslin should be held over the first finger of the left hand with the needle slanting toward the thumb of the left hand.

Hemming is ended by taking three little stitches one over the other.

If the thread breaks in hemming, cut it off about one-half inch from the last stitch taken. Then commence with a new thread as at first.

Method. — As before provided, abundant samples, blackboard drawings, and worsted demonstrations.

Teach the turning first with paper. This is not only easier for them, but it gives them the necessary practice

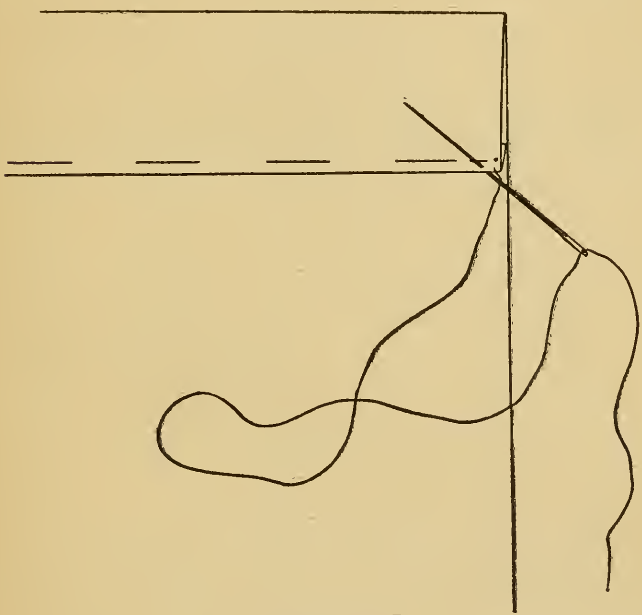

ILLUSTRATION *D*

without soiling the material. Require them to test the widths with a ruler.

When the turn has been made with the material, let them baste it neatly, first studying a basted (but unhemmed) sample.

Examine the hemmed sample. In this the stitches should be very large and made with thread of a contrasting color. It is an advantage to have the material thin, that they may hold it to the light, thus gaining a clear understanding of the stitch. Show them how to begin the hemming. Let them practise.

Teach the mending of the thread.

Lesson IV

Hemmed Patch

Facts. — *Cutting paper model for hemmed patch.* Cut a square of paper 4½ inches to represent garment to be patched.

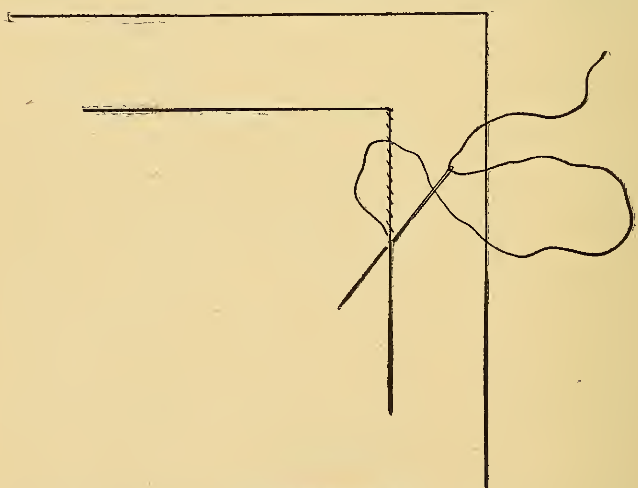

Illustration *E*

Cut paper 4½ by 3½ inches to represent patch to be put on. Draw on both papers vertical and horizontal lines at same distance apart to represent design to be matched. Fold the

square twice diagonally and cut out small hole in centre. Measure in one inch from edge of square on all four sides. Fold patch to fit, taking care to match stripes, and pin it on the wrong side.

Cutting Cloth for Hemmed Patch and Basting it Together; Hemming Begun. — Cut the cloth the same as paper model

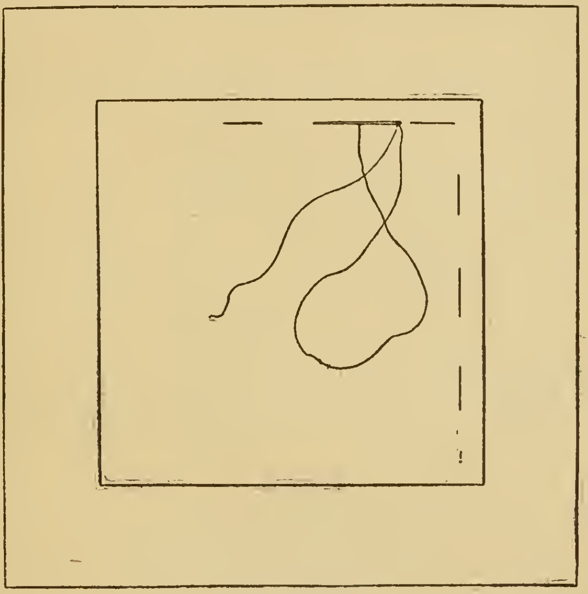

ILLUSTRATION *F*

and baste the patch on the wrong side, putting right side of patch to wrong side of garment, and using an even basting stitch one-quarter inch long.

Hem the Patch on. — In hemming, hold the patch in the left hand over the first finger. In taking the stitch, have the needle slant over the middle of the thumb-nail and pointing toward the arm. In hemming, it is important to

have the stitches of a uniform size, twelve to fifteen stitches to an inch being a good size for beginners. If the material is thin enough to see through in holding to the light, the hemming stitches will look like a row of small tents.

Method. — In the teaching of the paper model for hemmed patch, it is well to cut a model in front of the class so they may thoroughly understand it before attempting it themselves.

There is the same necessity for abundance of demonstration, material, and explicit direction in this as in all other lessons.

Describe the reason and use of patching.

Follow the steps as given in "Facts."

Points to be noted. — Have patch large enough to cover worn places as well as hole.

Be sure the threads of garment and patch run the same way.

Call attention to corners, and show that they should be perfectly square.

The shape of the patch depends upon the shape of the worn place.

Lesson V

Patch Finished — Weaving

Facts. — To finish the patch, insert the scissors in the hole in the centre on the right side and cut diagonally to within one-half inch of hemming all from corners. Cut out the triangular pieces of material, leaving one-half inch margin all around the square. At each corner snip in one-quarter inch and turn in material as far as cut, and baste down and hem.

Weaving. — Card $3\frac{1}{2}$ by $4\frac{1}{2}$ inches, worsted, two colors, and worsted needle. Measure in on all four corners of card three-

quarters of an inch and mark. On upper and lower edge of card make a row of pencil dots directly opposite each other and prick through. Thread the worsted needle with the warp thread, make knot, and bring the needle through the first hole

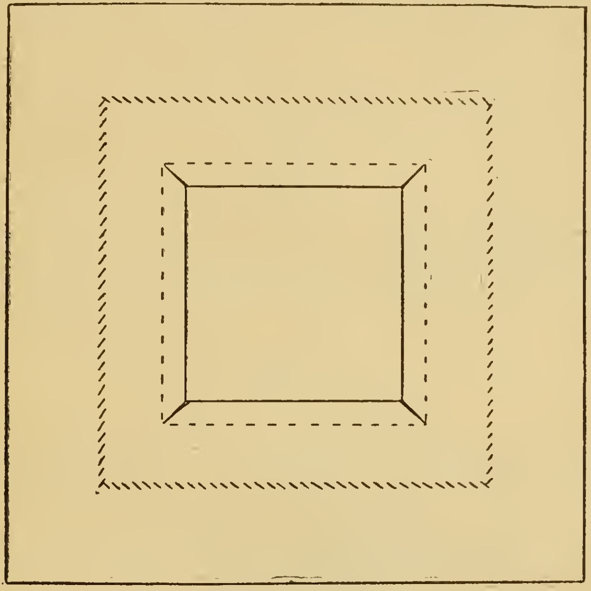

Illustration *G*

on top from wrong side. Carry worsted down to hole directly below, pass the needle through and bring it back through second hole, up to top again, and so on, until all the warp threads are in, and fasten on the wrong side.

Thread the needle with another color for woof thread and fill in, going under first thread and over second, etc.; the woof thread passing around the warp thread at the side makes the selvage.

Method. — Explain the process of weaving plain cotton cloth.

Make thoroughly clear the difference between woof and warp threads.

Describe a bias and illustrate it.

Have class draw warp and woof threads on blackboard.

Lesson VI

Darning

Darning on Stockinet. — Stockinet 4 by 2½ inches, darning needle, darning cotton.

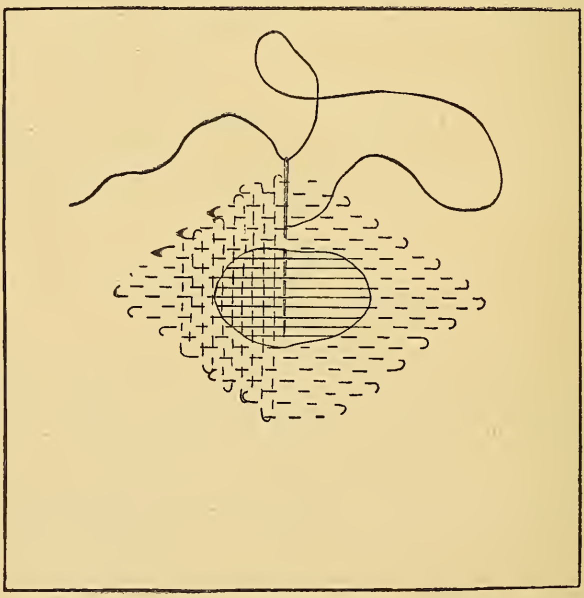

Illustration *H*

Cut small hole in the stockinet, baste it on a piece of stiff paper about $4\frac{1}{2}$ by $3\frac{1}{2}$ inches in size, being careful not to stretch the stockinet. Commence to darn by putting in the warp threads, beginning one-quarter of an inch outside of the hole. Take up a small quantity of the material on the needle, skip the same amount, and repeat until the line of stitches is one-quarter of an inch beyond the hole. In going back, do not pull the thread through tightly, but leave a small loop to allow for shrinkage, and follow the principles of weaving in taking alternate stitches. Put the warp threads in, in the form of a diamond.

In going back and forth over the hole be particular to catch all the loops around the edge of the hole. Have the woof threads follow the shape of the hole, going one-eighth of an inch outside. Show how the principles of weaving may be applied to darning.

Lesson VII

Darning (continued)

Darning on Cloth. — Cashmere 4 by 2 inches. In darning on cloth, use ravellings, if possible, to darn with; if not, have fine silk to match cloth.

Make a lengthwise cut in cashmere three-quarters of an inch long. Thread the needle, hold cut edges firmly together with thumb and first finger of left hand, and darn back and forth over cut, commencing one-eighth of an inch above and darning to one-eighth of an inch below the cut, making the darn about one-quarter of an inch wide.

Method. — In giving this lesson, do not permit the class to work too quickly, as a good result will not be obtained. Care and patience must be used. The edges must not overlap nor pull apart, and the threads must run the same as the material so that the stitches will not show.

Show the difference between an overhand and a hemmed

patch, tell which is stronger, which shows the least and why, and where used.

Explain that in patching a garment the square would have to be outlined with chalk or basting thread, as it could not be creased. Give the lesson as outlined.

Lesson VIII

Overhand Patch

Overhand Patch. — Figured percale or gingham, 70 cotton, No. 9 needle.

Cut two squares of material $5\frac{1}{2}$ inches, one to represent

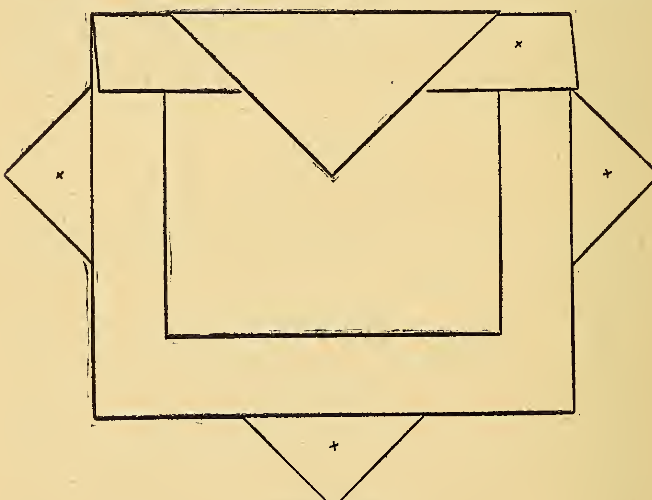

Illustration *I*

the garment, the other the patch. In the piece that represents the garment, cut a small hole in the centre, fold the square twice diagonally and crease, open the square and cut through the creased lines to within $1\frac{1}{2}$ inches of

the corners. Turn the triangles thus made back to wrong side. This makes the frame.

Place the square for the patch on the table right side up. Place frame over the patch matching the pattern exactly. Pin in place. Turn in patch at line of matching on upper side. Take out pins and put right side of garment to right side of patch at upper edge of patch and baste turned-in edges together.

Lesson IX

Overhand Patch (continued)

Overhanding. — Do not make a knot in the thread. Put the needle straight through both edges, pointing it toward the chest; draw the thread almost through, leaving about

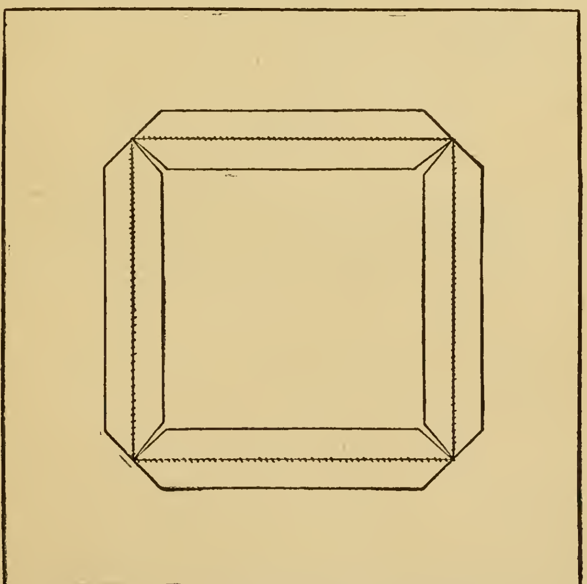

Illustration *J*

one-quarter of an inch; turn this end toward the left on the top of the seam where it will be held down by the first three stitches. Have the stitches rather close together, and in taking stitch always be sure to point the needle correctly. In ending, take three stitches back over last three, making cross stitches. Crease, baste, and overhand each remaining side by itself. When overhanding is finished, cut off all edges of seams to within one-quarter inch in width. Finish corners like illustration.

Show the difference between an overhand and a hemmed patch, tell which is stronger, which shows the least and why, and where used.

Explain that in patching a garment the square would have to be outlined with chalk or basting thread, as it could not be creased.

Give the lessons as outlined.

Lesson X

Sewing on Buttons

A button with holes must be sewed on firmly but a little loosely. Mark the place for the button; have a strong thread; take a small stitch, leaving knot on right side; put needle through hole No. 1 of button, pulling the thread through; place a pin diagonally across the button over holes 2 and 3 and sew back and forth five times through holes 1 and 4 (Ill. *K*); twist the pin so that it lies over holes 1 and 4 and sew five times through holes 2 and 3; remove the pin and pull the button up to the top of thread; bring the needle to wrong side of button and wind several times around threads and fasten on the wrong side.

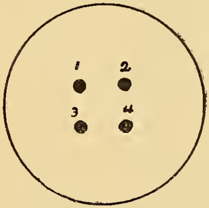

Illustration *K*

Buttons with two holes are sewed on in the same way and buttons with shanks or hooks, as shoe buttons, should be sewed on with the stitches taken parallel with the edge.

Method. — Have folded strips of cloth for the children to sew their buttons on, and demonstrate the lesson before the class with large piece of cloth and large buttons made of pasteboard so all can see.

Lesson XI

Mending Gloves

Facts. — This is merely fine overseaming or overhanding. For preliminary work repeat overhanding, taking care to have the stitches the same size.

Method. — When the children have had sufficient practice in overhanding, distribute among them gloves or fingers of gloves. Let them examine the overhanding. How does it differ from your work? Why?

What tools will you need for repairing gloves? (No. 10 needle, silk.) Why?

Let them bring gloves from home to be repaired. Collect old gloves for those who do not bring material from home.

CHAPTER XVI

HOW TO TURN AN ORDINARY SCHOOLROOM INTO A WORKSHOP FOR THE STUDY OF HOUSEHOLD ARTS

By M. ISABELLA McNEAR

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How to turn an Ordinary Schoolroom into a Workshop for the Study of Household Arts. — It will be a great help to the pupils as a lesson in thrift and order, and to the teacher financially, if she can get them to feel that the small apartment devoted to the study of household arts belongs to them while in it, and that they must do their part toward furnishing and keeping it clean. They can also help in selecting the materials after a previous discussion with the teacher about the color, design, usefulness, etc.

Subdivision of the Schoolroom into Other Rooms. — Having selected the room and decided how much money and help is available, the next thing to consider is the room itself: how large, how light, how many windows and doors, and how high the windows are; for on these things will largely depend the subdivision of the room into other rooms. For example: if there is only one door, it would seem to be best for it to open into the parlor, having the dining room and bedroom next to the parlor on each side. At the same time it is also necessary to have the lightest rooms for the

kitchen and laundry. It is especially necessary to have plenty of light in the latter. As the ordinary schoolroom has from four to six windows in it, — and these on two sides, — there must be one room, and in this case it ought to be the parlor, without a window.

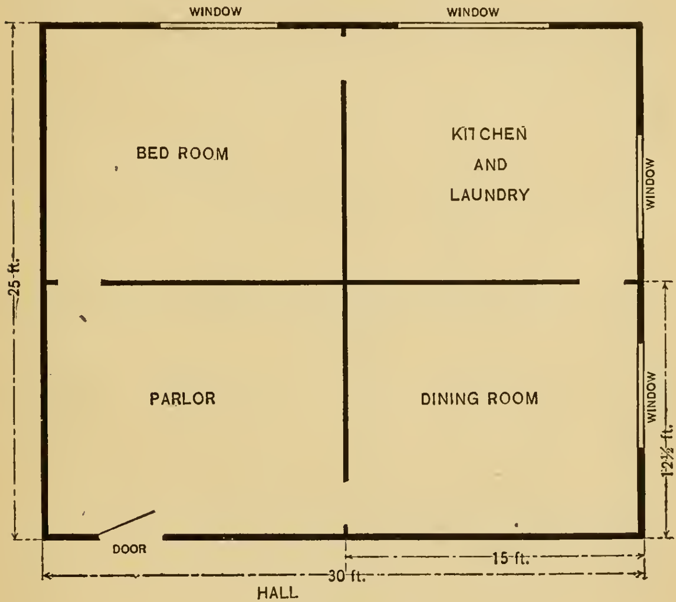

Diagram I

The next thing to consider is the size of the room, and into how many compartments it can be divided, and by what means.

If it is a small room about 25 by 30 ft., and divided into four equal parts, each part would be about $12\frac{1}{2}$ by 15 ft. This would give four fair sized rooms to furnish. But they would be too small for class work unless the

duties of the class be divided among the pupils, so that they can be scattered through the different compartments as in any ordinary house.

The laundry work could be taught in the kitchen. This might be a better plan than having a laundry, as the parents of most of the children do their washing, ironing, and cook-

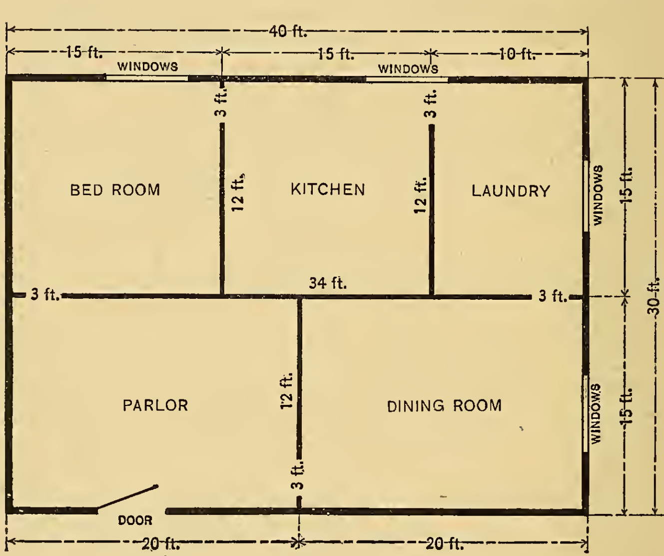

DIAGRAM II

ing in one room. Yet it will be very inconvenient to teach a class to wash, iron, and cook under such circumstances.

Such being the case, one corner of the parlor could be screened off with an ordinary small screen. Behind this screen could be placed a dining-room table and chairs. This would give an extra room for the laundry.

If it is a larger room, or about 40 by 30 ft., which is nearer to the ordinary sized schoolroom, it could be divided very

easily into five small rooms. The parlor and dining room could be 15 by 20 ft., and enough, say 5 ft., taken off the bedroom to give extra room to the kitchen; so that the latter might be subdivided into kitchen and laundry. If the front of the room is 40 ft., and the sides 30, this divison would give a bedroom 15 by 15 ft., kitchen 15 by 15 ft., and a laundry 10 by 15 ft., which is quite large enough providing the classes are taught systematically. If the dimensions of the room are 30 by 40 ft., 30 ft. front, instead of 40 by 30 ft., the three back rooms would all be 10 by 20 ft.; not quite so convenient, but still could be used very well. As a laundry should be a very light room, the rooms in the diagram have been so arranged that the laundry is a side room with a window on its longest side. This arrangement gives a window to all the rooms except the parlor.

Partitions. — By what means is the room to be divided? Ordinary roller blinds supported by pillars in the room would probably be too expensive; as would also be the case if venetian blinds were used. They could not be decorated as walls, and would be hard to keep clean. Moreover, if they were hung from the ceiling they would make the room too dark. Curtains are not to be considered if it is possible to get anything else. Not only are they too expensive, but become easily soiled. This necessitates the expense of having them washed. Besides, they collect and hold dust, giving a room eventually a dusty odor.

Partitions: Matched Boards. — The best and perhaps the cheapest partition could be made of matched boards stained and varnished to match the other wood in the room. It should be fastened to the floor, and, by cross pieces at the top, to the wall to make it stand firmly. It should not be more than 7 ft. high. This would give a wall a little higher than a tall person, and yet allow room for light and circulation of air over the screens to the compartments having no

window. A partition 6 ft. high would be over an ordinary person's head, and allow more space for air and light.

The partition should not extend to the wall; but there should be allowed 3 ft. at each end of the screen for a doorway.

Some cheap, pretty figured material, as cretonne, could be used for portières, and hung from the cross-bar that supports the partition.

Cost: Matched Boards. — If the room is 30 by 40 ft., taking off 3 ft. at each end, there would be two screens or partitions 24 and 34 ft. long and 7 ft. high. These would cost about $30. If an extra screen or partition is put up to divide the laundry and kitchen, it would be an additional 84 sq. ft., and would cost about $10 extra.

Small shelves, pictures, and looking glasses could be hung on a wall like this, which could not be if ordinary screens were used.

Screens. — Frames made of ordinary wood, stained and varnished, large enough to cover this space, would cost from $15 to $20 without the cloth. It would require about 53 square yards of cloth. And this at 25 cts. a yard would cost $13.25, bringing the cost of the screens to that of the partitions.

It seems hardly desirable to use cloth to cover so large a space in a room where such a variety of work is being done; as it becomes soiled from the dust, and absorbs the kitchen and laundry odors. This would necessitate replacing the cloth at intervals.

The ordinary folding clothes horse could be made into a screen by tacking on common floor matting. Either the white or figured could be used, and it is both durable and clean, as it can be washed. This would cost 25 or 30 cts. a yard. It would hardly pay to use a cheaper quality for such a large screen.

Tea cloth, obtained at large tea houses, is very pretty and artistic; as is also burlap, or what is commonly known as gunny cloth, and used for packing purposes. It is cheap, and, if tightly stretched, can be painted or gilded. Another pretty way to make a screen is to cover the frame with something that is thin as cheese cloth, and put paper over it. If a plain paper is used, it can be decorated by stencilling and the corners mitred. A very cheap wall-paper put on the wall with the wrong or white side out often gives a pretty and artistic effect. If screens are used, they should be fastened to the floor, and to each other, with brass or iron brackets known in trade as angles or knee irons.

The Floor. — The floor should be finished so that it can easily be kept clean.

Finish for an Old Floor. — A good finish for an old floor can be obtained by either of the following methods. First wash the floor thoroughly with either strong soap or lye; wash again with slightly acid water, using either vinegar or weak muriatic acid. This will neutralize the soda and give a better finish to the floor. If it is a rough floor, use the following recipe after washing as described: dissolve 10 cents' worth of glue in 1 quart of warm water; after it has soaked 12 hours add 1 quart of warm water, and 2 lbs. or enough yellow ochre to make it the consistency of cream; apply to the floor while warm. When dried, hard oil the floor. Another very good recipe for an ordinary good floor is, after washing as described, to oil with crude oil, turpentine, and stain. The proportion is 1 cup or $\frac{1}{2}$ pint of turpentine to 2 quarts of oil, and enough burnt umber or other stain to give the desired color. After this has dried rub over with common furniture varnish reduced to about the consistency of thin cream. This is neither difficult to do nor expensive, and if a class of girls could be interested in fitting up such a room; it would be both a practical and valuable lesson for them.

Parlor Furniture. — To impress upon the minds of the pupils what is meant by hygienic cleanliness, and the feeling of restfulness that comes from living in an absolutely clean and sweet home, there should be as few stuffed pieces of furniture, curtains, and doilies as possible. The writer has in mind, among other things, covered wooden boxes redolent with the odor of dust. These things do not keep really clean more than a few weeks. And unless the covers can be easily slipped off and washed, they give the room an untidy appearance.

Most of the furniture could be made of boxes by the students. Of course it would be necessary to buy the larger pieces.

Rugs and Carpets. — The parlor should have a light-weight rug upon the centre of the floor, or several mats. The mats could be made of remnants of carpets finished at the ends with fringe. Ingrain carpet would be best to use, as the other kinds are too heavy to handle easily, and too expensive. There is a kind of hemp carpet that is very durable and only costs about 35 cts. a yard, which would make either a good rug or mats.

The children could make rag mats by braiding strips of cloth collected from their friends, or the friends of the school. It should be torn into strips as class work, and the strips sewed together at home and wound into balls. The lesson in braiding could be given in the school and the work finished if necessary in their homes. The braids could then be sewed round a centrepiece as a part of their school work. Red and black strips make a pretty rug.

A drawn mat is not hard to make, and when properly snipped is very pretty. Simple designs can be bought which can be used as a lesson in colors.

Settees. — A settee could be very easily made by fastening together securely at their ends two cracker, or other long

boxes; and making a wooden cover for the top fastened on with either hinges, or pieces of leather about one inch wide and three inches long. If leather is used, there should be two strips for each hinge. They should be fastened on the box so that one end of the strip comes under the lid and the other end outside of the box. The second piece should be nailed close to the first only reversed as to the position of the ends. One end should be fastened on the outside of the lid and the other end inside of the box. This will prevent the lid from slipping out of position. The inside of the box and lid should be lined with a dark-colored cambric to match the ground color of the outside covering. Cut a long strip of the lining about $1\frac{1}{2}$ inches deeper than the box and long enough to allow some fulness at the corners; sew this around a piece of cambric just big enough to fit the bottom; place this in the box and tack the edge around the outside of the box. Line the lid with a straight piece, bringing the edges over the outside. If unfigured goods is used for the outside of the box, it can be drawn over the sides and ends in plaits or folds and fastened. Or if figured, it should be put on either as a plaited ruffle or plain. The top can be stuffed, or a long flat mattress like a cushion be made for it, having a narrow ruffle to fall over the edge. Plain square and rather flat cushions might be placed against the wall to form a back.

Chair. — A chair can be made by screwing or nailing two upright pieces of wood on the opposite ends of a square box placed bottom up unless it has a cover. The pieces must be placed to slant at a slight angle from the corners of the box and connected at their upper ends by a wide piece of board. The uprights and back can be sandpapered, oiled, and varnished, the seat stuffed, and the whole bottom of the chair, or box, covered with cretonne. The ruffle round the chair could be fastened with brass-headed tacks. A very good descrip-

tion of this furniture can be found in the June number of the *Ladies' Home Journal* for 1898.

Mantle Shelf. — A piece of board rounded at the ends and fastened to the wall with iron brackets makes a pretty mantle shelf. A piece of box can be used. Either paint, varnish, or cover with some pretty, cheap material.

Bookshelves. — Some pupil whose father has a grocery store might be induced to bring some small boxes of uniform size for a bookcase. Perhaps another pupil could get her father to plane the sides. Or the student could rub them smooth with coarse sandpaper, using what is called No. $1\frac{1}{2}$. If a smooth surface is desired, rub the last time with finer sandpaper. Oil with the crude oil and turpentine mixed according to the recipe for the floor. If three or four coats of oil are put on before the varnish, it will give a soft velvety finish. Of course each coat must be dry before another is put on. Use either a brush or piece of soft cloth. It is well to mix a little starch or white filling in the oil for the first coat, especially if the wood is soft pine. In adding the coloring or burnt umber to the oil, it must not be forgotten that pine turns dark with age, and therefore should be quite light when finished. This work seems hard, but the writer has always found the pupils not only willing, but anxious, to help in making such things. It is a good lesson because they use both their brains and hands. If whoever superintends this work can use simple tools, or if not, can take a few lessons in the use of such tools as are needed, the students can make nearly all the furniture. All that would be needed are: hand-saw, hammer, hatchet, rule, pencil, nails, tacks, sandpaper, brass-headed tacks, boxes, iron brackets, a piece of soft thin leather, thread, scissors, needles, cloth, and thimble. Certainly these are not very costly articles, considering the lessons taught.

Table. — A small round table can be made with the lids

of a butter firkin, using broom handles for the legs, and covering the top with felt and fringe. A small square box covered with a piece of carpet or cretonne makes a pretty stool.

Dining-room Rugs. — Cover the dining-room floor with a crumb cloth, either bought ready-made, or made of striped furniture linen or plain dark blue denim. The latter makes a pretty covering for the centre of the floor, also as a border with a centrepiece of either matting or carpeting, as a rug.

Sideboard. — Make a small closet or sideboard by placing a small long box endwise upon the end of a larger box. If these cannot be planed, oiled, and varnished, they should be sandpapered and painted both inside and outside. A dark red is pretty, though white enamel paint could be used. At least two coats of paint should be put on to hide the natural roughness of the wood. Shelves should be put into each box, and curtains hung in front of the larger box, on a brass rod.

Bedroom

Bed. — For the bedroom get a narrow white iron bedstead. This would be light and easy to move by the girls in such a small room.

Dressing-table. — The dressing-table may be made by covering a large drygoods box with white dotted Swiss muslin over a bright covering of cambric ruffled on. Green is pretty and clean looking. Some pretty toilet articles arranged on the top would serve as an object-lesson.

A looking glass could be hung on the wall, and dotted muslin, lined with green, draped over it, extending to the ends of the dressing table and forming a canopy at the top. This should be either fastened to the walls or to a wooden supporter fastened to the wall by means of an iron bracket; and extending forward over the looking glass and table. Of

course each teacher must use her own judgment, as in other matters, about the colors to be used.

If the students have had lessons in sloyd, they may be able to put one or two shelves in the box and use it for a linen closet. Finish the inside with sandpaper and two or three coats of white paint. The paint is not expensive, and can be bought ready for use.

Washstand. — A washstand can be made of another smaller box. Plane or sandpaper and paint white, especially the inside and top. The first coat should be flat paint and the last white enamel. Drape with dotted white Swiss over colored cambric to match the bureau; and cover the top with heavy white linen hemstitched.

Kitchen. — The kitchen should not be crowded with furniture if good work is expected. A stove, table, chairs, and closets are all that are needed.

Stoves. — The gas companies of some large cities will supply any housekeeper with a good gas stove, which, when a certain amount of gas has been used, becomes the property of the consumer. In this case it would belong to the school. It might be very easy to make such an arrangement for both the laundry and kitchen.

Table. — A plain wooden table about 4 ft. long with a drawer in it would be quite large enough. If desirable, a large drygoods box can be made into a table by sandpapering and painting as in the case of the other boxes. Only do not paint the top, cover it, and the ends if desirable, with white enamel cloth. Put a gingham curtain in front and use the inside for a closet. A shelf can be easily put in by nailing some wooden cleats on the inside and placing boards that are long enough for the box upon them. Such a table was planned by the writer for the teachers in the county colored schools of the South who were anxious to help their people to a better way of living by teaching the

children in their one-roomed schoolhouse how to cook such food as they can get.

Closets. — The closets could be made of boxes. But a larger one can be made of matched boards by a carpenter for about $10. It is not an extravagance, as it is very essential to have a good closet that can be locked.

Ice Box. — It is also possible to make a very good ice box by lining a box with zinc, and boring a hole in the bottom and also one near the top. The box must be placed upon legs and have a good cover, which should be zinc lined. Of course, while it might teach a lesson of what can be done, yet the girls would hardly be strong enough to make the box themselves. It would have to be done by a man or some strong boys.

Laundry. — For the laundry all that is really needed is a bench long enough to hold two or three tubs, a stool or short bench for the tub that should be placed near the stove; one or two chairs; a solid table; and an ironing board to stretch either from chair to chair, or from the back of one chair to the table. The smaller articles necessary are 5, 6, and 7 lb. irons, two polishing irons, iron stands, shirt and sleeve boards, one two-quart agate saucepan, dishpan, long spoon, pail, small round boiler, clothes stick, washboard, large dipper, blanket sheet, iron holder. The light tubs, costing about 50 cents each, are better than those that are heavier and more expensive. They will last about as long and are not too heavy to lift. In furnishing a school laundry, or school kitchen, light-weight small things are better than large and unwieldy ones, which are not easily handled by the students. Things should be cooked in such small quantities in a school that only small utensils are needed.

Laundry Table. — The laundry table can be made either by the students, of a large box, or by a carpenter. If made by the students, a large box should be used, shelves placed in it,

and a curtain hung across the front. The writer has such a table made by a carpenter. The top is of heavy wood having solid ends, with a partition running through the centre from end to end. The sides are divided into compartments with shelves. One or more of the compartments having no shelves are used for larger articles, as long bottles, basket, wringer. The compartments serve as a closet in which all small articles common to a laundry can be kept; also the clothes which the girls have washed and which they will iron during their next lesson. If the stove is large enough, part of the girls can iron while the others are washing. Two gas stoves can be used in the laundry: one large enough to put a round wash-boiler upon it; or a double stove would be better, as it would allow room for the kettle at the same time the boiler is on; and another stove, with an attachment for irons, for the girl who irons the articles which have been washed during the previous lesson.

Brush Box. — A very convenient box for dustpans, brushes, etc., can be made by using a box with a lid, as a varnish or cracker box, sandpapering, oiling, and varnishing; or by putting on several coats of paint. It is better to simply oil with crude oil the tops of tables and benches and any surfaces that are to be used for work where hot water or grease is liable to be spilled, or such as have to be washed frequently. No filling or varnish should be put in the oil.

In a room divided as this would be, large classes would be impracticable. It is well to have the pupils alternate in their work from lesson to lesson. Let those who cook the small lunch to-day set the table and take charge of the dining room in the next lesson; so with the bedroom and laundry. As unused things will grow soiled from handling and dust, there will be plenty of chance to use the laundry for the ordinary linen of a household. This arrangement

will allow several girls for each room, and also give them a chance to do some sewing, as keeping up the stock of towels, bed linen, etc.

There are so many ways in which girls can be made to feel that they are keeping house, with all the ordinary interests of a housekeeper whose life is full of thoughts of the home and the influence it has for good on those who come in contact with it.

After the room has been selected and the partitions put up, the girls might take their first lesson in furnishing. A blackboard is very necessary, and should be placed in either the kitchen or laundry. The girls could go there each morning for the general outline of their work, also for any remarks to be copied or remembered.

It must be remembered in furnishing a room like this that it should be done with taste and simplicity; that stuffed things grow rapidly dingy, and have to be replaced; that children should not only be taught to work well and neatly, but the general air of the whole apartment should be so sweet and fresh that their senses would become accustomed to it and miss it. This cannot be obtained in a room crowded with furniture, nor if it is of a kind that will grow soiled and musty and cannot be washed.

As a last remark the writer wishes to say that she has tested the statements made in this chapter, and knows that the work given is perfectly practicable.

If small classes are impracticable, then either larger rooms must be provided, or else the same space must be divided into smaller rooms. Therefore Diagrams III.–V. are submitted in the hope that they may prove of use.

Besides the gas range provided for in the kitchen, and the round gas stove for the wash-boiler in the laundry, there should be provision made for several small stoves. Either

a table, a long narrow box, or a shelf could be used. The box, if used, should be either sandpapered and varnished, or painted to look neat, and fastened so that it will stand securely on the ground.

A shelf of heavy wood from twelve to eighteen inches wide and long enough to hold two or more stoves could be

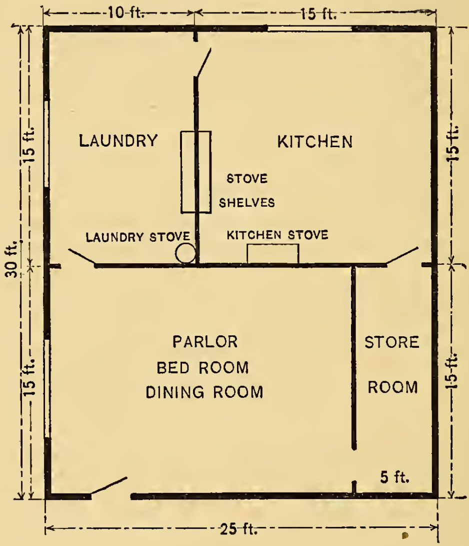

Diagram III

fastened to the wall. It should be made either stationary or to fold down. If stationary, the space between the shelf and floor could be enclosed and used as a closet. The shelf should not be more than twenty-eight inches from the ground. The top should be covered with zinc: and the wall faced up from the shelf about eighteen inches. This should be done as much for cleanliness as safety.

If gas stoves are used, they should be screwed to the table by means of holes bored through the feet.

If oil stoves are used, a band of zinc about one and one-half inches wide, with the top edge turned, should be soldered on to the strips of zinc, which is on top of the table or shelf. This should be shaped to form a case in which the

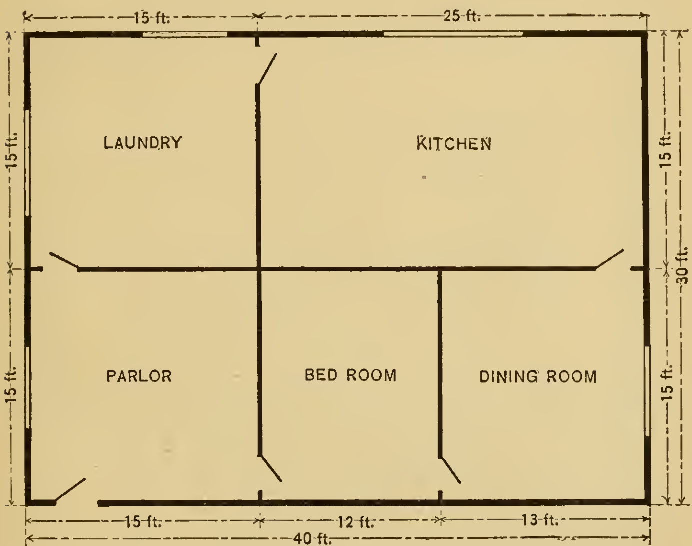

Diagram IV

stove can stand. The case should be made to fit the outside of the stove tightly enough to hold it firmly when placed in it to prevent its being knocked over by the children.

The writer once used for two years a long dining-room table covered with white enamel cloth, and having a strip of zinc running through the middle lengthwise with cases

for four small stoves. With these four small stoves and an ordinary range in a small room, she often taught classes of

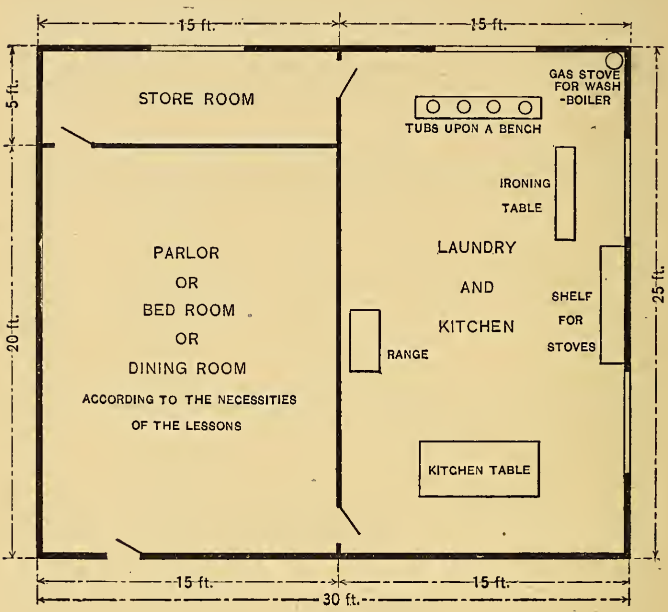

DIAGRAM V

twenty-five. Nevertheless, a stove for each student is the ideal toward which all should strive.

DIAGRAM VI. — Stove Shelf

If this shelf is made to turn down, the strip of zinc should be made to fit the shelf with turned edges and places for screws, so that it can be removed when desirable; or buttons can be screwed to the table so that they can be turned to hold the strip in place. Small tin ovens can be bought that fit these stoves, and in which very good work can be done. A class of fifteen or twenty could be easily managed with three or four small stoves and a range.

It might be better to have oil stoves, as the pipes in large buildings are often too small to allow enough gas to pass through them to fully supply so many burners through sub-pipes. With several such small stoves, combined with the range and a gas stove large enough to heat a medium sized round wash-boiler, one fair sized room could be used for both the laundry and kitchen. This arrangement would give a little more room, save the expense of a partition, and be a little easier for the teacher.

If the room is too small to divide as described, it could be divided into two or three compartments, keeping one for the kitchen and laundry during the whole year, and using the other at intervals for bedroom, parlor, and dining room. It could be used during the first part of the term as a bedroom, next as a parlor, and during the last part of the term, when the girls know more about cooking, as a dining room. It would of course be necessary to change some of the furniture each time. In this case a storeroom would be needed. It might be well to consider this when getting the furniture, so that some of it could be used for all three rooms.